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Fulham's Power Station.

LAST week the London County Council decided to oppose the application made by the Fulham Borough Council for leave to extend its power station in Townmead Road.

It would appear that the opposition is of a tactical nature, put forward with the object of securing the Council's right to object to details of the project at a later stage, as it was stated that the second report of the committee investigating the sulphur problem with regard to the new Battersea station, the publication of which we reported last week, had not been received when the agenda was drawn up. This attitude is consistent with that adopted at the time of the issue of the earlier report, when the L.C.C. decided to await the final report of the committee presided over by the Government chemist before expressing its definite views on the subject. There is, therefore, nothing in the present decision of the Council to lead one to suppose that it will continue its opposition to the Fulham scheme after it has had an opportunity of considering the findings of the committe with the care that their importance warrants.

It is understood that the Electricity Commissioners have fixed December 16th as the date of the public inquiry. What we should deprecate most strongly is that the cautious attitude of the L.C.C. should be mistaken and form the cover for the same kind of attacks on the policy of erecting a base-load station at Fulham as were made earlier in the case of Battersea. In the latter instance there were grounds for fear—if one assumed the bankruptcy of science—that grit and sulphur emission from the station would have a harmful effect on the neighbourhood; colour was lent to this by the unfortunate experience at Barton, which is, by the way, situated well outside of any residential area.

In the light of the tests undertaken by the London Power Co. there is no reason to believe that the presence of either the Battersea or Fulham stations will injuriously affect the important urban neighbourhood in which they are to be erected; indeed, it is at least a reasonable assumption that the atmosphere will be very much the purer on their account, since their output will be used, to an appreciable extent, in substitution for the domestic coal fire, which is responsible for so much of the dirt we breathe. We would, on logical grounds, have

preferred that both stations should be situated well outside of London, down the river and nearer the Kent coalfields, but no practicable proposals for transmitting some 700,000 kW into the heart of London at a reasonable cost have been seriously put forward—and no less an amount has to be provided within the next decade to meet the growth of load in the west of London that we hope and expect to take place—and opposition to the scheme can prove only factious or destructive.

The Silvertown Company.

The adverse report upon its past year's working presented by the Silvertown Company at last week's annual meeting mentions the very serious fall in the prices of raw materials during the year as being the principal cause of the company's loss. It was necessary to write down the stocks by a very substantial amount and this, combined with the lower prices ruling for the company's products, was sufficient to wipe out the gross profit and produce a net deficit of about £96,000 for the year. Although the trend of the price of rubber during 1929 was steadily downwards, it could reasonably have been expected that a halt would be called. As it proved, however, from being at 8½d. per lb. at the close of 1929, rubber continued to fall and reached 6½d. before the end of August. The price of lead followed a similar course, though in less marked degree. As regards copper, which had been on an even level for nearly a year, there was a sudden price-break in April last which reduced the price of electrolytic bars from £84 to £66 per ton in a week.

In the face of this, can it be wondered that companies which by the nature of their business are compelled to carry large stocks have been badly hit? Or that buyers and purchasing departments have had their calculations upset? The Federation of British Industries recently admitted that it had not foreseen, and could not possibly foresee, the headlong fall of prices when preparing its forecast of probable conditions during 1930.

One or two shareholders of the Silvertown Company were inclined to blame the company's purchasing department, but we consider that this was not altogether fair. Mr. Lloyd, the recently-appointed joint managing director, said that a new system of stock control was being instituted. We trust that this, and the other improvements which the company is making, will restore it to prosperity and enable it to re-absorb all those employés whose services have had to be dispensed with and many more besides.

Hack-saw Machine Treatment.

It was put to us in rather plain terms during a visit to the hack-saw factory of Messrs. James Neill & Co. (Sheffield), Ltd., a description of which appears elsewhere in this issue, that hack-saw machines are not given the same careful treatment in the engineering industry, particularly the electrical industry, as all other machine tools. Hack-saw machines, in the majority of engineering works, are not treated as machine tools, but are relegated to some out-of-the-way corners of the machine shops, where the light is far from perfect, and once installed in these unsuitable positions they get little, if any, skilled maintenance service. The hack-saw machines are therefore at a disadvantage, compared with other machine tools in the shops, and under such conditions they have very little chance of functioning at maximum efficiency.

No engineer would allow his lathe spindle to develop a shake, or the centres to become non-concentric; neither would he permit his milling-machine bearings to be slack, or the slides to be too easy, and still expect satisfactory output and efficiency from the machine. In the same way, it is unreasonable to expect the hack-saw machine to give the service it is undoubtedly capable of giving unless care and attention is devoted to its maintenance.

Production costs in hack-saw cutting can be substantially reduced by attention to the machine and careful selection of the type of blade for particular work.

The Functions of the D.O.T.

From its inception we have actively supported the Department of Overseas Trade, believing that it represented an instrument capable of rendering considerable service to British industry and trade. Mr. Ernest Sharp, in an article which appears in this issue, apparently considers that our continued support of the Department is another example of the triumph of hope over experience. He maintains that while it is doubtless admirable in its way, the D.O.T., either because of inherent defects or by reason of its circumscribed powers, has been found ineffective and inutile, so far as his business is concerned. While we were of the opinion that some of Mr. Sharp's criticisms had a reasonable amount of justification, we could not agree with much that he wrote. Rather than attempt a defence of the Department, however, which would incidentally be a defence of our attitude towards it, we passed Mr. Sharp's article on to the Department, requesting it to answer the attack itself. The result is a rejoinder by Mr. G. M. Gillett, M.P., the energetic Minister who has charge of the Department of Overseas Trade.

Between the two our readers will be able to form their own opinions as to whether the Department is, or is not, of any use. Whatever their judgment, we contend that the Department is at least the only impartial clearing house for Dominion and foreign commercial information, making it available to all who produce and sell British goods, and if it is not so effective as it should be, it is because it is not receiving that support from trade and industry to which it is entitled and which they are able to afford.

Consulting Engineers.

Speaking at the dinner celebrating the 21st anniversary of the formation of the Association of Consulting Engineers, Mr. A. H. Dykes combated the view, held in some quarters, that the day of the consulting engineer (properly so-called) was ended. He pointed out the advantage of having a scheme prepared by an independent authority to which firms could be invited to tender. This, he said, applied particularly to conditions abroad, where the consulting engineer who desired the best material had done good work in getting orders for British industry. Mr. Dykes also rightly pointed out that no profession worthy of the name could consist of a number of men working merely for what they could get out of it, without ideals or corporate spirit. An association which sets up a standard of conduct for the profession, in addition to giving a constant reminder that its outlook is not bounded by commercial considerations will, it is to be hoped, reap a reward outside of its objective, since, by its educational influence on the public, it will tend to make a high professional code successful in the terms of "vulgar commerce"—to employ an expression that has been provocatively used in our pages recently.

Moreover, there are many who, appreciating that the economic trend is for larger and larger industrial combinations, wonder whether scope will be left for the individual of independent character who has in the past proved so strong a buttress of our national greatness. In consulting work, freed from the influence of the policies of large corporations or companies, there can be found an outlet for that spirit of initiative and enterprise which becomes more and more necessary as a counterpoise to great organisations. Consulting engineers were twitted, by some of the speakers at the dinner, with regarding themselves as a kind of aristocracy; there will, we believe, be room for an aristocracy in democratic institutions for just so long as the aristocracy by its high standards of conduct justifies its existence.

Engineering and its Amenities.

There was another theme of current interest that was well stated at the dinner of the Association of Consulting Engineers, and that was Sir John Brooke's exposure of the fallacy that works of utility must be a century old or so before they can be regarded as things of beauty. He instanced

Waterloo and Marlow bridges, which were not constructed to improve the scenery but to be used for everyday purposes. He asked why engineers should apologise for their products by trying to make them look like something else, when their beauty could be made to lie in their appropriateness to their purpose.

MR. D. A. BREMNER developed the theme in reference to the reduction in the ugly noise and vibration of 'buses in recent years; that is another way of saying that the improvement has been brought about through the greater efficiency of the 'buses. It has always seemed to us that a proper understanding of this aspect of efficiency by the public is necessary if engineering is to be a progressive force, producing its own amenities and receiving the respect of those it benefits. It is for this reason that we have from time to time taken opportunities to draw attention to the subject.

Coal and the Rates.

A NEW duty has been added to the engineer, or, perhaps we should say, he has been redefined as "one who repairs the ravages of the politician."

This is a deduction made from a question asked by MR. GEORGE BALFOUR (rhetorically we assume, since the speaker denied that he was a pessimist) at the annual dinner of the South-Midland Centre of the I.E.E. held last Friday at Birmingham. Mr. Balfour was comparing the increased charges on electricity supply undertakings due to rising local rates with the reductions effected in fuel cost during the past few years, and asked whether it was worth while to strive to obtain relatively small economies in the use of fuel in the circumstances. The answer is that of course it is. However discouraging it may be to see the wealth he has created frittered away, the duty of the engineer is still to seek to utilise most efficiently the forces of nature, whatever others may do. As a private citizen, he may use his influence, if he thinks right, for the reduction of public expenditure, but that is another matter.

There is a further aspect of this question of the value of savings in expenditure on fuel that must be small in relation to the total costs of producing electricity, to which we have referred on a previous occasion. No informed person expects such savings to be directly reflected in the price to the lighting consumer, but it needs only a slight reduction in coal costs to enable tariffs to be quoted to long hour industrial consumers that will secure an increase in output which will ultimately benefit consumers of all classes.

Wits and Brains.

SPEAKING also at the Birmingham dinner the President of the I.E.E. made a notable epigram, namely, that industry living by its wits would go under before industry living by its brains. We take it that MR. C. C. PATERSON had primarily in his mind the need for establishing a scientific basis for industry, but as he had just before then referred to the necessity of reconciling the interests of shareholders with a sense of responsibility to the community, it is probably legitimate to regard the dictum as having a secondary application also. The point is one that requires no labouring.

Successful Soil Heating.

SOIL-HEATING by electricity has been carried out in various parts of the country with varying degrees of success. In some cases the principal advantages have been found in forcing early vegetables and in growing fruits out of season with a view to meeting continental competition. In the case of the experiments carried out by the South Wales Electrical Power Distribution Co., a report of which is given in our "Notes" section this week, MR. C. T. ALLAN found that cumumber plants grown in electrically-heated soil not only came to maturity very much earlier than those sown in the ordinary hot bed, but continued to bear fruit right on into the autumn, by which time the control plants had entirely withered. Moreover, the yield was exactly four times as great.

Electrically-propelled Ships.

IT was extremely gratifying to hear from the head of the P. & O. line at the Batti Wallahs' luncheon last week that the results obtained by the use of electricity in his fleet had been so entirely satisfactory. LORD INCHCAPE may be regarded as an independent, if favourable, witness, and his remarks on the excellent performance of the electrically-propelled *Viceroy of India* should do much to encourage the development of this type of vessel.

Manufacturing Progress in Japan.

IT was only a few years ago that Japan was one of the foremost markets for foreign electrical machinery; today, Japanese manufacturers of electrical machinery and equipment are able to furnish practically all the country's requirements. There are many factors which have helped to bring this about, all indicative of the determination of the Government to make the nation self-sufficient in its key industries. This policy is strengthened by a high import tariff; Government preference for home-made goods; early adoption of new types of machinery and apparatus; low cost of development of new designs; co-operative financing of users and manufacturers by banking institutions; and alliances with foreign manufacturing concerns.

It is now universally recognised that the Japanese have passed the so-called imitative stage, and in many scientific and technical lines have developed to a point where they claim to have something to teach other nations. The practice of sending industrial and engineering missions to other countries, where they are courteously received and given every opportunity to visit and inspect factories and industrial plants has been of great benefit to Japanese manufacturers.

Both buyers and manufacturers in Japan are distinctly progressive in their policies. Users of electrical apparatus and plant continuously watch with keen interest any internal and external developments in the electrical industry. Should a new type or design of machine or apparatus appear which is not procurable in Japan, samples are imported, they are studied in minute detail, and a design considered to be suitable for the market is evolved. Otherwise a manufacturing agreement under licence from a foreign manufacturer is concluded. It will be seen that the Japanese electrical manufacturing industry enjoys every advantage for its development.

When Winter Comes.

IN our issue of November 7th we asked "Where do Contractors Go in the Winter Time?" suggesting that during the season they should get together to read and discuss papers regarding their work, to their common benefit. The contractors have now provided a good and sufficient answer; we extract the following from the December *Electrical Contractor*:—

> "The answer to the REVIEW'S initial question concerning the hiding place of electrical contractors in winter time is, of course, easy enough. The winter time is the contractor's 'season,' when he is busily at work scraping together a few coppers to maintain his small wife and large family through the lean and hungry summer period. And hence the absence of 'meetings' and 'papers' during this busy season: but we agree absolutely with the REVIEW in thinking that installation topics are among the most important yet least discussed subjects confronting the entire industry. On the other hand, how the matter is to be remedied we simply do not know. It represents a terrible fight to get the average contractor to climb any sort of public platform—and this despite the fact that, once on his feet, he can be depended upon, almost invariably, to put up quite a good show. But to ask him to do so in the winter time is to ask for trouble!"

We agree that the discussions at the contractors' annual conferences reach a high, though eminently practical, level, but we still feel that they should not confine their efforts to the summer. Perhaps it is also permissible to say that there is nothing Cassius-like in the contractors we see at the annual conferences, but that may be because the "lean and hungry summer period" has not then run its full course.

Hack-saw Blade Manufacture.

A Description of the Operations in a Modern Works of Sheffield Crucible-steel Manufacturers.

THAT in the manufacture of hack-saw blades there is a great deal more than meets the eye was evidenced during a recent visit to the Composite Steel Works of Messrs. James Neill & Co. (Sheffield), Ltd. Great accuracy and care are needed in the production of "Eclipse" blades, and the experience of the makers as manufacturers of crucible steel for over 38 years has been of the greatest service to them in the production of the steel for the blades. The essential qualities of hack-saw steel are hardness and toughness, and the tungsten-alloy steel which is melted in Messrs. Neill's crucible furnaces is claimed to be particularly suitable for the purpose.

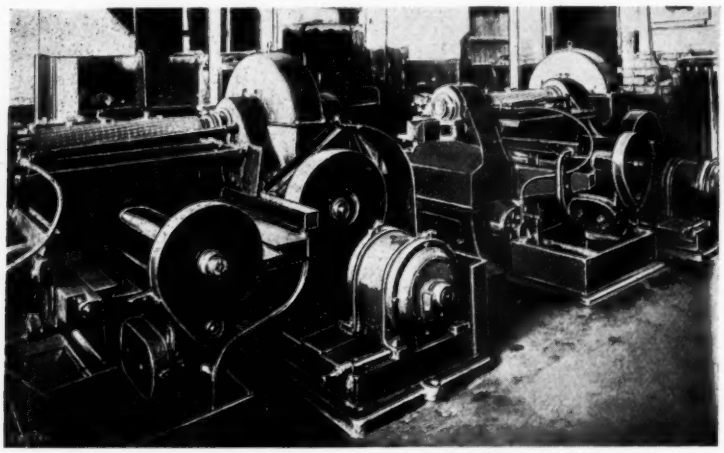


Fig. 1.—Self-contained Teeth-milling Machines.

A technical staff in the works laboratory is constantly engaged in carrying out experimental work, research and analysis, not only on the raw material used in the manufacture of the steel, but also on the finished ingots and hack-saw blades. Every ingot is analysed and subsequently classified, and in this way great uniformity and regularity in the steel used in the manufacture of the blades is made possible.

The ingots are rolled into sheet form about 20 in. wide and 6 ft. long, of the various gauges required, and the sheets are then cut by automatic guillotine shears into the necessary widths and lengths for the various sizes of blades manufactured.

These strips are then clamped together in batches of up to about 3 gross, each forming a solid block, and the teeth are milled by Lincoln-type slab milling machines specially designed and constructed for the purpose. Tables in which the blades are clamped are drawn under revolving cutters. Fig. 1 shows a couple of self-contained milling machines, each driven by a 10-h.p. B.T.-H. motor controlled by an oil-immersed starter. Each milling machine is designed to deal with up to six gross of blades in 25 minutes.

The next process is that of setting the teeth, so as to give them sufficient clearance to enable each tooth to do its full share of the cutting. This is effected by machines of ingenious construction in which the blades are passed through rollers between setting wheels. The feeding of the blades on each machine is effected by a ratchet wheel which engages with the blade teeth.

The set strips are then ready for the next processes of rounding the ends, punching the holes and branding. These operations are carried out on specially-designed heavy presses, one stroke of the machine blanking the strip into two blades, and at the same time punching the holes, rounding the ends, and branding the blades with the "Eclipse" mark. Fig. 2 is a view of the setting and punching shop, showing on the girders overhead a 7½-h.p. and a 15-h.p. motors belt driving through shafting the various machines.

The next and probably the most important process is the heat treatment and tempering. However perfect the mechanical operations may have been, a blade made out of the best crucible steel would be ruined by indifferent hardening or tempering. Modern hardening furnaces are employed, and are controlled by pyrometers; further, automatic bells control the human element and fix for the operator the exact length of time the blades are in the furnaces, so that the period of "soak" is definitely fixed for each particular size of blade. For hardening, the blades are heated up to approximately 780 deg. C. in specially constructed furnaces, and then

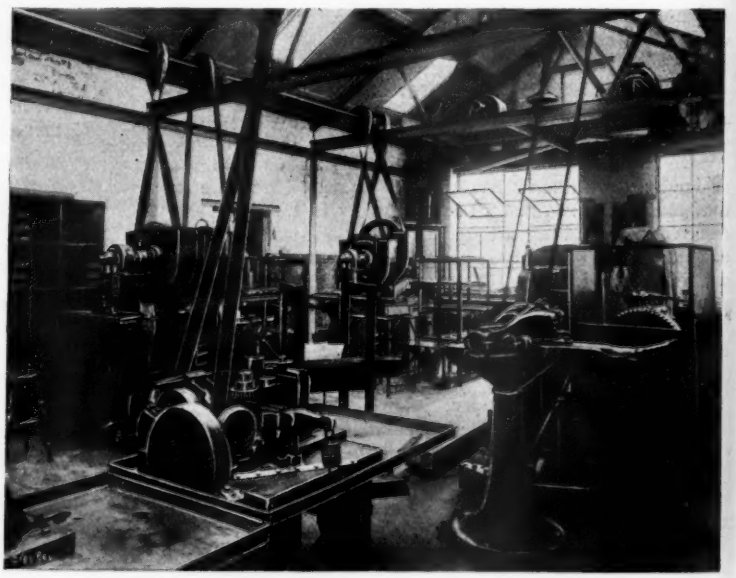


Fig. 2.—Corner of Setting and Punching Shop.

quenched in pure sperm oil. Fig. 4 shows one of two Wild-Barfield electric furnace equipments employed for hardening, one of 8- and one of 12-kW. The furnaces are of the induction type and are supplied at single-phase, 200 V, 50 cycles. A feature of each of these machines is the magnetic detector by means of which the correct hardening temperature of the blades is denoted; this, of course, is based on the principle that the non-magnetic point synchronises with the "change point" of steel. The oil is removed from the blades by means of oil-recovery plant, after which the blades are treated with turpentine.

The next process is tempering. A temperature of 375 to 450 deg. F. is required for this, varying according to the size of the blade, and the process is carried out in either the ordinary type of oil-bath tempering furnace or in a specially constructed gas-heated muffle furnace. Finally the blades are softened at the ends by passing them on an endless belt over a series of burners. This operation is necessary to prevent the blade breaking through the holes when tensioning it up in the frame.

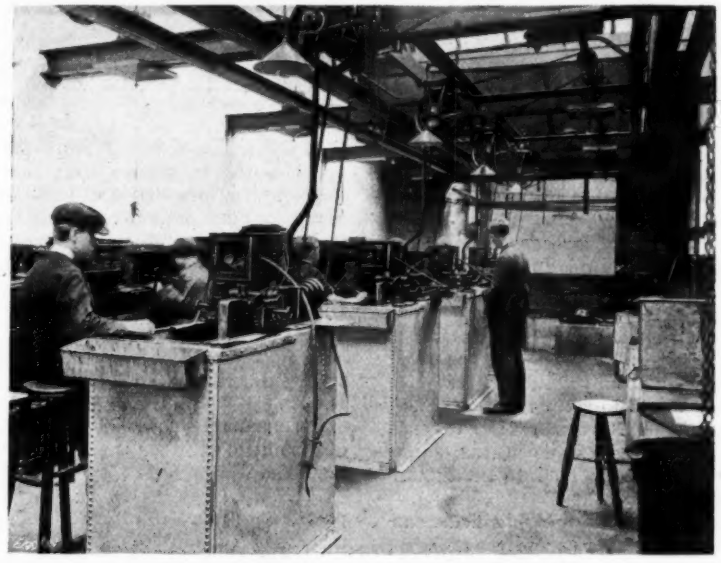


Fig. 3.—Flexible-blade Hardening Machines.

processes. For instance, flexible blades which are produced specially for use by unskilled labour have only their teeth hardened. This is effected by passing the teeth edges only through gas jets and plunging the blades immediately into oil. Fig. 3 shows a row of machines employed for this purpose, driven by the 7½-h.p. motor shown at the rear right under the girders. In order to remove the scale and give them an attractive finish "Eclipse" high-speed-steel blades are sand-blast cleaned. Fig. 5 shows the equipment installed for this purpose, which consists of an electric motor-driven air compressor, a compressed-air container, and a chamber in which the blades are treated, with special arrangements for the protection of the operator.

It is interesting to note that as the result of increased business Messrs. Neill are having built a new factory adjacent to the present one. We understand that it is intended to house the whole of the hack-saw department in the new premises, which are being constructed along up-to-date lines, with every facility for efficient working and every convenience for the welfare and comfort of the workpeople.

Most of the machines referred to were designed by the Company, to whom our thanks are due for permission to view its works and to take photographs.

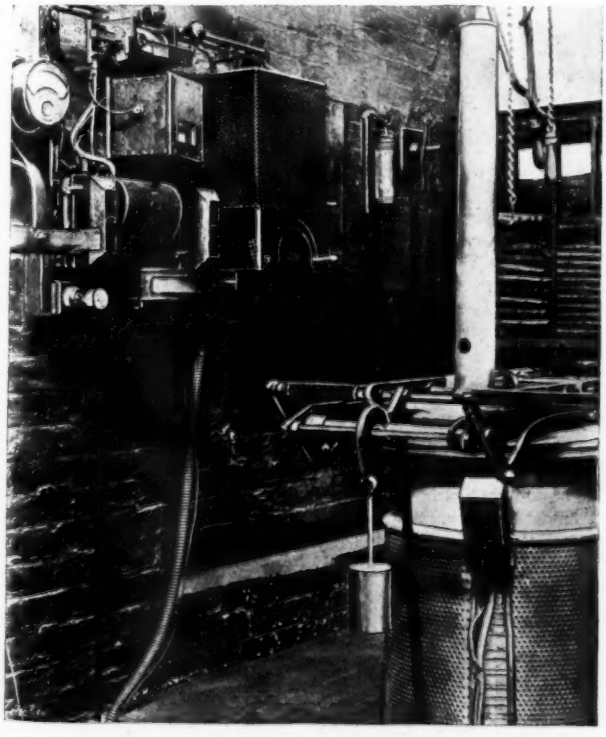


Fig. 4.—Electric Furnace with Magnetic Control.

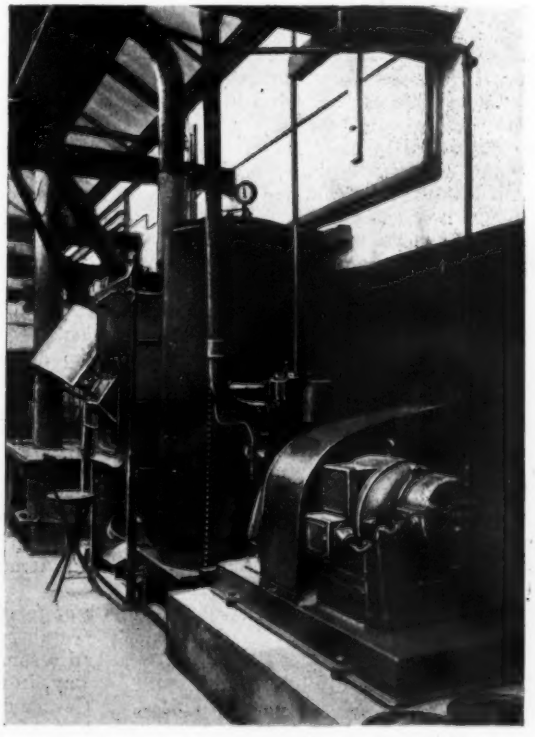


Fig. 5.—Sand-blasting Equipment.

The blades are then greased, examined, and taken to the warehouses for packing, storage and dispatch.

Generally speaking, the foregoing processes apply to all types of blades produced in the works, but a few particular products are submitted to special pro-

The D.O.T.—Is It Any Use?

A Categorical Criticism.

By ERNEST E. SHARP, A.M.I.E.E., F.B.H.I.

THE attitude of the ELECTRICAL REVIEW always has been one of commendation of the Department of Overseas Trade. As the Editors are allowing me to express an opposite view, I would say at the outset that I think the difference between our points of view is that the ELECTRICAL REVIEW is influenced by its appreciation of the good such a Department *might* do, while I, fully appreciating the same point, know that the possibility is seldom turned into a fact and that the help to the trader is negligible compared with the effort and the cost. I have kept quiet on the subject for quite a long time now, but am moved to return to it because, in addition to the editorial on November 21st, there is a very full statement in the same issue of the claims of the D.O.T., which enables me to go into the matter point by point as well as generally.

In the editorial it is pointed out that big firms can have their own intelligence services on overseas affairs, but that the smaller firms are those that benefit by the work of the D.O.T. Now I think that my firm can claim to know if this is so. In 25 years we have built up a fairly good overseas business, while the number of our employés has grown from seven to about 500. Throughout the existence of the D.O.T. we have endeavoured to benefit by it. Even before it had a separate existence we took part in the first effort in our time by our Government to organise a British section in a foreign exhibition and took the inevitable gold medal at the Turin Exhibition of 1911. We have in the past subscribed to their special information service, exhibited at the British Industries Fair, asked for all sorts of information, and I, personally, have interviewed most of the Commercial Secretaries when they have been home, and quite a number of them in the countries to which they are accredited. Here, I want to make it very clear that I have always been treated by the Department with the utmost courtesy and they have always done whatever was possible for me according to their constitution or their view of their duties. Perhaps the trouble is that, as a Government department, they dare not be very commercial.

Now to come down to some definite criticisms—and for these I will follow the list of the Department's services as set forth on page 863 of the ELECTRICAL REVIEW of November 21st, asking, incidentally, who are the electrical engineering members of the Overseas Trade Development Council, and reminding the reader that we are considering the matter from the point of view of the small firm to whom the Department are said to be specially helpful.

1. *Import and export trade statistics.*—These are usually lumped under a few main headings and tell the small firm nothing. Instancing my own business, time switches never get a separate heading, so this item of the D.O.T. " activities " is no help.

2. *Foreign catalogue library and samples of foreign competitors' goods.*—I don't know about the catalogues, but I cannot believe that the D.O.T. ever had a sample foreign time switch in their possession. Anyway, in this Free Trade country it doesn't need a Government Department to get us competitors' samples!

3. *Details of import restrictions, regulations and tariffs.*—I doubt if any firm is going to do much business in another country without a local agent. This agent always keeps his principals informed of such things as a matter of course.

4. *Details of shipping and transport costs.*—What sort of a firm needs a Government Department to tell it these?

5. *Classified lists of importers and agents.*—The agent is the important item (he will deal with other importers) and a list is of little use. The D.O.T. have *never* found a satisfactory agent for my firm. I have found them through trade friends, personal calls, or direct communications from agents. In cases in which these avenues have failed and I have looked to the D.O.T. for help, they have been unable to give it. This, to my mind, is one of their biggest failures.

6. *Commercial news service.*—As a rule, one gets such information from one's agents long before the D.O.T. get the news. Most business of importance is either common knowledge and doesn't need a D.O.T. to dig it out, or else the D.O.T. never hear of it until after the order is placed.

7. *Annual reports by overseas officers.*—Scissors and paste, often plus an almost standard paragraph on how the English manufacturer neglects his opportunities.

8. *British Industries Fair.*—A very fine exhibition indeed—for home buyers. Everybody doing overseas business has known for years that it is held at the wrong season to be of much help to our export trade. This point is buried from time to time under an inquiry. I count this date question as one of the D.O.T.'s worst crimes!

My criticisms are not made in any spirit of antagonism to the D.O.T. On the contrary, I would like to do anything in my power to add to their usefulness. To that end I have given much thought to what is wanted to help such firms as our own whose contributions to export trade, small though they may be individually, must, in the aggregate, form a considerable percentage of the whole. I have come to the conclusion that there are three ways in which the D.O.T. could change from a mere carriers-out of routine to a Department of real value to England's commerce.

I put the change of date of the B.I.F. first as being probably the easiest to carry out. The report made by the Birmingham Committee on this point was backed by men of practical experience who are as puzzled as everyone else by the neglect to act upon it. The second alteration necessary is that Trade Commissioners, Commercial Secretaries, or whatever else they may be called, should be men of commerce. The present gentlemen, if I may be permitted a welter of mixed metaphor, are square pegs in round holes, neither fish, flesh, fowl nor good red herring, poor relations of the diplomatic family. However capable they may be in their own ways, they can never handle the job as well as men who have had commercial careers. Not one of the many I have called on has been able to help me, although all have been most willing. I have occasionally been able to get down to " brass tacks " with their poorly-paid assistants, who are sometimes picked up locally and have had some commercial experience. I have not much hope that this fairly obvious suggestion will be acted upon; possibly our politicians would be afraid that good commercial men might not be sufficiently mindful of diplomatic matters. If this be so, it would be better to spend the money through such an organisation as the F.B.I. Then we could have men who would mix more in business and make more of their opportunities with the local Press and by speaking. It should not be too much to expect that they would feel it not beyond their duties even to endeavour to swing business towards England. It will, I think, surprise many readers to know that some of our present Commercial Secretaries have told me that they regard this as something much below the dignity of their positions.

Thirdly, the D.O.T. should tackle the agency question seriously. There are many countries where it is not possible for an English firm to get a good agent. This may be due to a dearth of such men, the few there are being already booked. In other cases, language ties cause them to prefer a German, Swiss, or other foreign agency to a British one. One can't go far in any country without a good agency, and many a time the D.O.T. have been unable to supply one. Here is a case in which a little money, or even a guarantee, might induce suitable Britishers to set up as representatives for a few (non-competitive) firms like ourselves in countries where there is the need. If the money, or guarantee, cannot be squeezed out of the Government, the D.O.T. might get a few firms together to carry out the same idea. Such a scheme might even be linked up with the endeavours of Sir Francis Goodenough to promote the learning of foreign languages.

I hope I have made clear some of the difficulties in the way of English firms doing overseas business and how completely useless the D.O.T. have been so far in solving them. These are not new views of mine—some of them I have been putting before various people at the D.O.T. for a long time past. Some of the staff, I think, agree with me. It may be that they all do, but have no power to alter matters. I hope (without much faith!) that my small contribution to the subject may bring some helpful results.

The Department's Reply.

By G. M. GILLETT, M.P., Parliamentary Secretary to the D.O.T.

I have read with interest Mr. Sharp's criticisms of the Department of Overseas Trade. Mr. Sharp writes quite naturally and very properly from the point of view of a manufacturer of electrical time-switches, a highly specialised article in which there is necessarily only a very limited demand in the world's markets. Mr. Sharp has taken, to increase his sales, the course which the Department is constantly urging upon manufacturers. He has travelled abroad and studied markets for himself. He has informed the Department of his intention, and the Department has notified its overseas officers of Mr. Sharp's visit and instructed them to assist him. Mr. Sharp has interviewed the Department's overseas officers, has taken their advice, has appointed reliable agents, has returned home, and has very kindly and courteously written to the Department to express his appreciation of the services which its overseas officers have rendered to him. As a result of all this Mr. Sharp's trade has increased. I congratulate him and wish there were more like him; but Mr. Sharp has no further use for the Department of Overseas Trade.

There is such a thing as generalising from insufficient particulars. A number of the services which the Department of Overseas Trade renders to industry are not specially applicable to the manufacture of time-switches, but it does not follow that they are useless. We are unfortunately unable to supply Mr. Sharp with useful statistics on import and export trade. This is due to the fact that the Customs authorities of the world have neglected to distinguish time-switches from other electrical apparatus. Nevertheless, the Department answers on an average about 180 inquiries a week on statistical matters. Mr. Sharp has good agents who keep him informed on tariff matters. Nevertheless, there are a number of firms in the country who are not so fortunate. The Department answers 500 inquiries per week on tariff questions. The shipping of time-switches is not a complicated matter and a Government Department is not required to give information on this, but there are more complicated shipping and transport questions in connection with other trades, and the Department answers on an average 230 inquiries per week on shipping questions. Of the 14,000 foreign catalogues at present in the Department's Foreign Catalogue Library only five relate to foreign time switches. Nevertheless, the Library as a whole appears to be useful, if one may judge from the fact that about 200 catalogues are lent every week to British firms. Lastly, although it may not always be possible for the Department to find, on demand, a qualified agent for so specialised an article as time switches, it can and does find agents for dozens of firms every year.

Mr. Sharp's more general criticisms are twofold: (1) that the Department's overseas officers are not men of commerce, and (2) that the British Industries Fair is held at the wrong date. To deal with the first, I take it that the essence of the criticism is not that the officers in question are not experts on time switches, or textiles, or tinplate. Nobody can expect one man to be expert in every branch of industry. The complaint, as I understand it, is that the officers in question are in the main men without business training. It may surprise Mr. Sharp to learn that many of our representatives are men of practical commercial experience, and I might add that in several cases we have lost the services of valuable officers who have been induced to return to business life. The ideal Commercial Secretary or Trade Commissioner would be, of course, a man with a first-class business training over a quarter of a century, a similar amount of diplomatic experience and a considerable measure of initiative, but such an ideal officer is, to say the least of it, difficult to find. We must strike the best compromise we can. Mr. Sharp plumps for the commercial experience—never mind the diplomatic ability. The larger electrical contracting firms who frequently desire the assistance of a Commercial Secretary in securing a large contract are likely to give more weight to diplomatic ability. We cannot please everybody, but we can see that business opinion has a voice in the selection of these officers. The fact is that the majority of the officers of whom Mr. Sharp complains were chosen by selection boards upon which representative business men had a considerable majority over official members. Mr. Sharp states that some of our present Commercial Secretaries have told him that they regard influencing business towards this country as something "much below the dignity of their positions." I think he must have misunderstood. I must confess to a doubt whether, if he intended consistently to neglect his duty for the future, any Commercial Secretary would have confided this intention to a comparative stranger. In any case, if Mr. Sharp will let me have, publicly or privately, the names of the officers concerned, the matter shall be immediately investigated.

The other main complaint is that the date of the British Industries Fair is wrong. This is characterised as the Department's "great crime"; but this date has not been fixed and maintained by the Department in the wickedness of its heart. There are over 50 trades represented in the British Industries Fair, of which the electrical trade is one. It is admitted that in the opinion of the electrical trade the date chosen is unsuitable, but a balance of opinion has to be taken in a matter like this, where the opinions of all the people mainly concerned are in conflict. The question of the date has been considered again quite recently by the Chelmsford Committee which has taken evidence from all the interests concerned, and the Department will no doubt be guided by the findings of this independent committee whose report has just been laid before Parliament.

In connection with the Overseas Trade Development Council, Mr. Sharp asks, incidentally, who represents electrical engineering? The answer is Mr. P. J. Pybus, C.B.E., M.P.

The First Essential.

What makes a successful Contractor? The author discusses how, and by whom, inquiries are obtained, dealt with, and converted into orders.

By H. R. TAUNTON.

WHAT is the first essential to success in an electrical contracting business? Capital, says one; organisation, says another; luck, mutters the cynic. But it is none of these: two of them are but a tool and a method, and the third a weathercock. A million pounds and all the red tape of Whitehall cannot extract success from an empty order book—and there lies our answer. Success can only come to the man to whom orders come. Not always then. But although electrical contracting is one of those hazardous trades to which an order means the chance of a loss, yet only in an order is there any chance of a profit to it. Orders, then, and plenty of them—in short, an adequate turnover—is without dispute the first essential to the electrical contractor who would have the success which counts with his banker.

His trade, of course, is not peculiar in that. Fashionable portrait painter or coffee-stall keeper, none of us can carry on long without orders. What distinguishes the contractor from most other strugglers for a competence is the wide diversity of the sources from which his orders may come, and the elastic methods that he must employ in seeking them. Others may be able to rely solely on introductions, on shop display or advertisement, or on the enterprise of their travellers. They are able to concentrate on the one or two methods which custom and experience dictate as efficient and sufficient to their selling needs. Not so the electrical contractor. Not only in the highways but in many and strange byeways he must seek his bread, and hope for occasional butter. It will be interesting to explore some of them and discuss the methods most likely to make of them avenues to prosperity.

"Turnover, and How to Secure It," would make an engaging title for a handbook. Did it only contain one infallible rule, it would make as large a fortune for its author as for its million eager buyers. Unfortunately, there is no such thing as orders to order. The art of obtaining them is not to be learnt from the printed word. Not set rule, but energy, enterprise, tact, flair: these are the magnets to draw to him who has them the favours of the coy "prospect." All these are qualities only to be looked for in a lucky natal star: they are not to be acquired. But experience also counts, and it is something to learn from it what are "prospects" and what are not.

The "Personal Touch."

To a contractor the most valuable source of possible orders is, or ought to be, his personal connection. A personal connection is not merely his satisfied customers, or the architects or other professional men on whose estimating lists he is, but also his friends and acquaintances in business and social life. Orders are apt, like kissing, to go by favour. At least as many plums are picked up at a friendly dinner table or in the smoking room of the club as are ever handed out by the cold indiscrimination of the "lowest tender." The man with a wide circle of well-wishers ready to pass him the word when an inquiry is in the air, to give him useful introductions, and to pull strings to ease the straits of competition can afford to laugh at the cut-throat scramble of the less lucky.

Happy, too, is he who has one or more pet architects or consultants on whose continuous favour he can rely. There are many and well-known architects who, unless a client makes a point of it, never trouble to put out to competition the bulk of their sub-contracts. They argue, quite legitimately, that they know from past experience that So-and-So will, without the need of constant supervision, give them sound work at a fair price, and that, since he is not exposed to competition, they can rely on his disinterested technical advice and his grateful co-operation. Why should they incur the expense, trouble, and delay of obtaining tenders from half-a-dozen strangers, and the risk that the successful one will "let them down," squabble over dubious extras, and scamp his work in the effort to squeeze a profit out of a cut price? Their attitude is quite understandable, indeed commendable, so long as their clients' ultimate interests are not prejudiced—and they rarely are. The only objection to it comes from contractors who are outside the charmed circle; and that ceases the moment they are admitted to it.

Consultants, on the other hand, do not commonly make such comfortable pets. Their position, often as the intermediary between an architect and a sub-contractor, usually makes it imperative on them to obtain competitive tenders against their specifications. But they can reasonably, and some of them do, recommend the acceptance, not of the lowest price, which may be that of a stranger, but that of some other tenderer whose methods are known to them and upon the quality of whose work they can rely.

The Architect and Builder.

Failing such favours, the general body of architects and consultants remains perhaps the most important source to which the contractor must look for inquiries. None are so small or so insignificant that they can safely be ignored. The unknown man of to-day may to-morrow land a rich commission and become the arbiter of a valuable contract. Luckily, the small man is usually accessible enough, and his cultivation need not occupy too much of the time which must be spent in the siege of the more impenetrable sanctuaries of the heads of the profession.

Builders, and in a less degree, decorators and furnishers, are another fruitful field of inquiries. Some of the large firms of builders have their own electrical department, and others have associated companies or their pet contractors. But the rest often have sub-contracts to place, though usually of a smaller amount than those dealt with directly by an architect or consultant.

Surveyors, house and estate agents, supply companies, semi-public institutions, large manufacturing firms, distributors, multiple stores, are others who (although some of them may have their own electrical staff) often have contracts and jobbing work to place. All should be on the contractor's list, to be visited and, on occasion, assailed by suitable methods.

All these are sources from which something more than a single order is to be expected; that is to say, they issue, at intervals, specifications and inquiries in the normal course of their business. Their connection is therefore of particular value to the contractor. To secure it requires a method quite different from that to be adopted towards the casual private customer. Almost the only one that is of any avail, more especially in the

London area, is the employment of an outside representative, to make systematic personal calls.

In all but three or four of the largest provincial towns the number of architects and consultants is so limited that one of the principals of the contracting firm may well make the necessary periodical calls on them in the odd hours of the week. In such cases an outside representative may be superfluous, unless he can be fully and usefully employed in following up direct inquiries and estimates. In a country town, for instance, a good man with a car can earn his keep easily enough by calling on the prospects within a radius of twenty or thirty miles, with an efficiency and an economy impossible if post and rail have to be relied upon alone.

The Outside Representative.

In London, however, the systematic cultivation of consultants and architects is a whole-time job, and not an easy one. The goodwill of the professional men which is worth having is a delicate flower, and its cultivation requires a rare combination of qualities. So rare, indeed, that the man who possesses them all is hardly to be found. Let us consider the specification of the ideal contractor's representative.

He must have technical knowledge sufficient to enable him to talk intelligently on his subject, to make suggestions to meet the simpler problems of lighting and power, to give, when necessary, approximate prices, and to take ordinary quantities and details for the information of his estimating department. Many a small but lucrative inquiry or order may be lost if a representative is unable to inspire confidence in the man he is talking to, and has weakly to admit the necessity of referring back to the office some elementary point which a busy architect wants settled on the spot. At the same time he must have the modesty and prudence to know his limitations, so that he will not rashly commit his firm to obscure and hazardous undertakings. No reasonable professional man will expect him to clinch offhand a thousand-pound contract without consulting his principals.

He should be something of a draughtsman, able to read and mark up plans correctly, or to get out a rough one himself; able, too, to take tracings, and, on occasion, to make a clear freehand sketch.

He must be in touch with the most modern advances in illumination, heating, signs, domestic apparatus, and telephones and signalling gear: or, if the peculiar activities of his firm demand it, in power equipment and such specialised work as theatre or kinema installation. He should be able to advise upon the latest types of fittings, "artistic" or commercial, and to discuss all the possibilities of labour-saving appliances, and he should be acquainted with general catalogues and prices. In short, he should combine in himself the broad outlines of the technical equipment of the supervisor, the estimator, and the draughtsman, and withal he must add to this, which can be acquired, certain personal qualities which must be born in him.

Personality and Energy.

A forceful personality is perhaps the chief of them. Any number of young fellows can be found who can make out a long list of architects, call upon them regularly, as regularly be told that Mr. So-and-So can't see them, and make up a pretty report of their negative results. Mere waste of 'bus fares and shoe-leather, and of a salary which would be better spent on circulars. The only type of representative who can bring in results is the one who, whether it be determination, ingenuity or tact, has the precious talisman which carries him past the outer defences of office boy or typist to speech with the principal or his chief draughtsman. The man who can do that, not simply in offices where he has established an acquaintance by the accumulation of years, but with strangers, has the one great secret of the born salesman, rare and never-to be-sufficiently prized.

The contractor's representative has the handicap that he has few, if any, talking points, and no speciality to form his card of introduction. Unless the architect has already had experience of his firm, when no difficulty arises—if it has been a happy experience—its name is meaningless, and none carries more weight than another. Particularly is this the case in London, where there are so many big, first-class firms who have carried out big, first-class work. It is useless to boast of a reputation or parade a list of contracts executed, where there are so many equal. The representative has to stand on his own feet and rely, not on his firm's prestige, but on his own.

Energy and enterprise are other obvious qualities that he must have. To these, and equally important, should be added the acumen which scents out a possibility before the pack gives tongue. Any fool can walk along the street, see a site being cleared for a new building, and scurry off to find himself one of a hundred besieging the harassed and by then unapproachable architect. The man who knows all about it before the housebreakers do is the man who has the first and the best chance of, at least, the inquiry.

The value of such acumen is even more marked when it comes to the smaller, less obvious inquiries, renewals and extensions, which are not signalled by builders' hoardings or trumpeted in the trade papers. Because they are so much the more difficult to track, many representatives ignore them, pretending to concentrate on the "big stuff." Never was a greater mistake. The wise man will be glad of the smallest inquiry which will help him to make his footing in an office from which he can hope later for bigger and better orders.

Method, flexibility, probity and courtesy are other qualities of the ideal representative. He must be well dressed and should be of good appearance, with a cultured diction. He must not be too young or he will lack the necessary experience. He will not know the ropes nor have a basic connection. Nor must he be too old. Too often by the time he has the experience and a connection he has lost the energy and the keen enthusiasm to extend it or to make the most of it. Finally, not to tabulate all the characteristics of an Admirable Crichton, he must be of more than ordinary sociability. And a certain conviviality is practically inseparable from his calling; so much so that, unfortunately, carried to excess, it has been the ruin of many an otherwise good man.

"Salary and Commission."

Perhaps there is no man alive who could fully comply with our ideal specification. Electrical contractors always find the most difficult post on their staff to fill satisfactorily is that of the outside representative. The lucky man who finds one who is sober and honest and really pulls something more than his weight, should grapple him to himself with bonds of generosity. His expenses should be liberal, subject to ordinary scrutiny; he should have a fair basic salary which will help him to keep his self respect during the inevitable lean times, without encouraging him to rest on his oars; and naturally and essentially, it should be supplemented by a commission on his results.

That point of commission is the rift in the lute which so often ends the harmony of his working agreement with his employer. To enumerate all the difficulties with which it bristles would need more space than is at our disposal; and to suggest a solution of them, a volume which would be neither final nor satisfactory.

The ordinary traveller usually has to handle articles at a fixed price with a known profit, which he sells with no other help than the selling organisation of his firm. The contractor's representative, on the other hand, has to deal with varying contracts, with very varying returns, and he has to depend on the co-operation of others, both to convert his inquiry into an order and to make it a profitable one.

Commission on turnover tempts the man to go after unprofitable business, and to disputes with the estimator if he loses an order which he thinks might have been secured by a keener figure. Commission on profits leads to the facile objection that he has no control over them, and to quarrels again with the buyer or supervisor on whose efficiency they depend. Too small a commission disheartens him. Too large a one

may eat up the contractor's profit. A sliding scale is full of pitfalls, particularly when "extras" are in question.

Commission on repeat orders, on orders from the firm's own connection, from the representative's original connection, from the connection that he has made since joining, on orders resulting from inquiries handed him to follow up, or from inquiries initiated by him and followed up and secured by a principal: all these are points which must be envisaged and defined in any agreement with him, if endless questions and disputes are to be avoided.

Whatever terms are mutually agreed, it is essential for the further avoidance of disputes that full daily or weekly reports should be put in by the representative, defining the origin of every inquiry and order secured by him, against the time when he will want to claim commission on them. If there is any dubious item in his report, let it rather be argued then than later. If all his claims are decided, for or against, and initialled by a principal at the time of their first inception, when the facts are fresh in the memory of each side, the eventual payment of commission, when due, becomes a matter of frictionless routine. It is obviously important, too, that the jobs concerned should be scrupulously and accurately costed, especially if commission is based on profits.

Without such records and costs it is difficult to judge whether a man is paying for his keep in commission, salary, and expenses. The mere amount of the commission which he earns is not necessarily an index of the real value of the orders that he brings in. If, however, he is bringing in profitable business, then the larger his commission cheque the better pleased should be his employer. He should not, as some do, look askance at big money so earned, and seek, by a modified agreement or by haggling about doubtful cases, to cut it down. The labourer is worthy of his hire; and such an asset to a contracting business as a successful representative is certainly worthy of all his, and of whatever little plums he can earn besides.

So much space—but not so disproportionate a space—has been given to the outside representative as a means of getting orders that his junior cousin, the canvasser, must be dismissed in a few words. All that has been said of the qualifications of one applies on a minor scale to the other. Canvassers, however, are rarely employed by the larger firms, certainly not in the London area In the suburbs and the provinces they may be useful occasionally in following up some extension of the supply company's mains; but in such cases they are generally drafted temporarily from the indoor staff. Firms holding an agency for some speciality may with advantage employ a whole-time canvasser if the area to be worked is large enough. The question of commission in such cases is usually a simple one.

Lady canvassers have been tried for the sale of domestic appliances; not with conspicuous success. Apart from a proverbial fluency, the average woman has few of the necessary qualifications; and in any case the task of a canvasser is sometimes not a pleasant one, even for a case-hardened man.

(To be concluded.)

Our Overseas Electrical Trade.

A Review of the 1929 Imports and Exports.

IN our issue of November 14th, pages 835-6, we published comparative figures of the exports from Great Britain during 1928 and 1929 of the principal groups of electrical goods and apparatus and machinery to the leading consuming countries. There has now been issued the import volume of the annual statement of trade of the United Kingdom for 1929, which enables us to give our usual yearly article and charts showing the trend of both import and export trade. In 1929 imports of machinery, as well as of goods and apparatus, showed advances in value, the respective increases compared with 1928 being £163,000 and £1,800,000. On the other hand, exports of machinery showed a decline—in weight of 2,015 tons and in value of £335,000. Exports of goods and apparatus rose last year to £13,159,000, a total nearly as great as the high record of 1926; batteries and

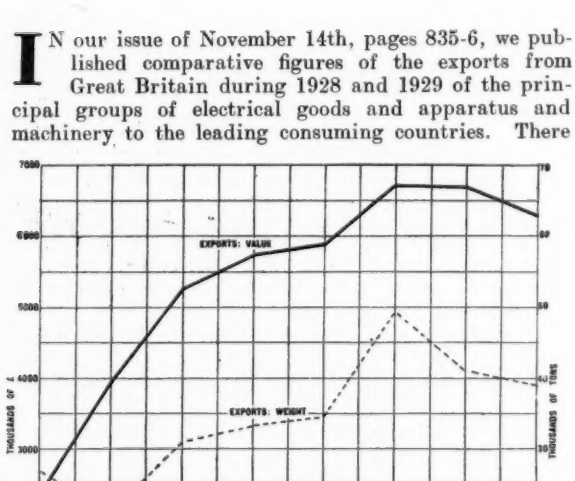


Fig. 1.—Imports and Exports of Electrical Machinery.

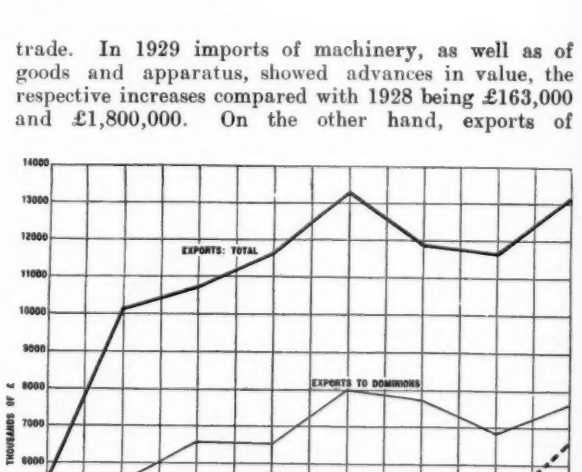


Fig. 2.—Imports and Exports of Electrical Goods and Apparatus.

accumulators and submarine cables were the only groups showing noteworthy decreases. The net result was a favourable balance in the electrical trade generally of about £11,500,000, or approximately £500,000 less than in 1928.

The general tendency over the past few years is shown graphically in figs. 1 and 2, the latter indicating at the same time the proportion of the total value of electrical goods and apparatus taken by British countries.

Figs. 3 and 4 show the leading customers for goods and apparatus, but apart from those shown, the United States may be mentioned with purchases largely unspecified, totalling £280,000, Italy with £500,000, also

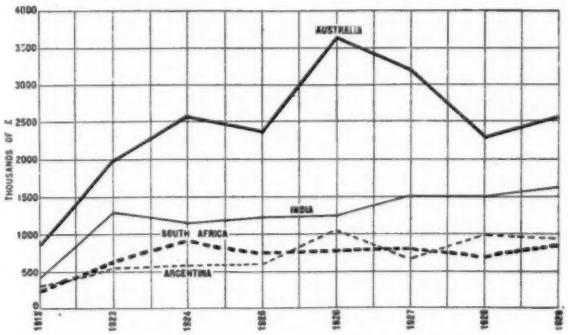


Fig. 3.—Destinations of Electrical Goods and Apparatus Exports.

largely undetailed, France with £236,000, Holland £337,000, including £129,000 worth of radio apparatus, and Chile with £255,000.

Exports of insulated wires and cables continue to progress, and at an accelerated pace, as will be seen from fig. 5. These still account for over 30 per cent. of the total exports of electrical material other than machinery.

The radio export trade has not made the forward movement that might have been expected from an industry supplying a comparatively new requirement. The adverse balance is increasing. Shipments of such apparatus, other than valves (at £950,000), were rather below the average value of 1925-28, while the import value jumped to £1,428,000, compared with an average of £488,000 during 1925-28. Similarly, imports of radio valves doubled in number on the year, the figure being 1,506,000 against exports of only 430,000.

With regard to the export trade in electrical machinery it is found that overseas business in traction

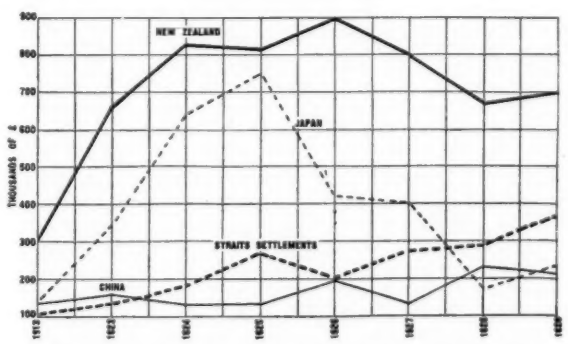


Fig. 4.—Destinations of Electrical Goods and Apparatus Exports.

motors continued the decline of the past five years or more, and at an accelerated pace, the total being only £293,800, as compared with £475,200 in 1928; every market except Australia contributed to this decrease. The balance of the trade in glow lamps continued in our favour.

While exports of a.c. motors were less in value than for any one of the previous five years, in weight they were more than in 1926. Foreign purchases were £200,000 in value against £304,800 in 1928, which, however, was a higher figure than has been recorded since 1921. Exports to the Empire showed a slight recovery, notably on Indian account. There was also a slight recovery in the Empire's purchases of d.c. motors, namely, to £273,320 against £257,600 in 1928. The level is, however, much below the average since 1920. The small but consistent advance recently of Canada's share is noteworthy, the 1929 figure being 268 tons, value £43,770, against 125 tons, value £21,055, in 1925. The total value of a.c. generators exported last year was £699,220, which, while well below the exceptional figure of £847,000 in 1928, was higher than in the preceding six years. Noteworthy items were exports to Russia £107,200 and to Japan £50,150.

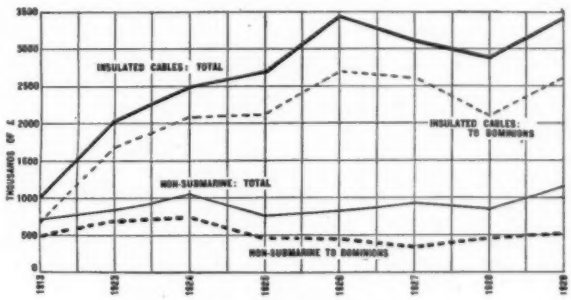


Fig. 5.—Cable Exports.

In converting and transforming plant our export progress on the rotary side was not maintained, there being a distinct decline in shipments to British countries. Exports of static transformers, however, while falling from £584,000 in value in 1928 to £531,000 in 1929, showed at the same time a rise in weight from 5,014 tons to 5,093 tons, the last-named being the highest figure ever recorded. It is satisfactory to note the fairly consistent progress made in the export to British destinations of control and switchgear.

The concluding item in the machinery group is one of £1,159,500, representing exported plant which, for no apparent reason, it has not been found possible to

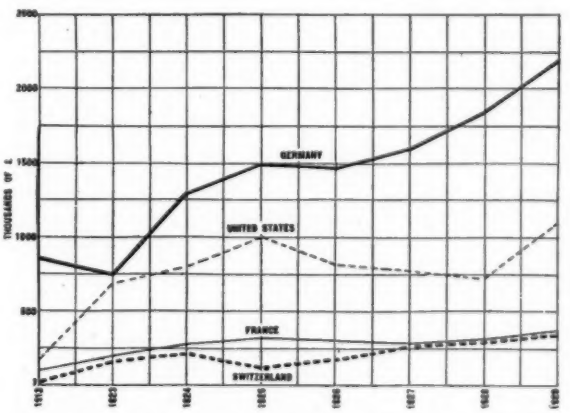


Fig. 6.—Origins of Imported Electrical Goods and Apparatus.

specify. This seems a large proportion of the whole trade to group as " not elsewhere specified."

It is instructive to analyse the proportion of our exports of electrical machinery going respectively to foreign countries and to British destinations. Of last year's total of £6,346,000, the sum of £2,198,000 represented foreign purchases and £4,150,000 shipments to the Empire. These totals all show a slight decline on 1928.

With regard to the import trade, Germany was again the largest supplier with a total value in the two groups of £2,376,000, as compared with £2,034,000 in 1928,

the United States coming next with £1,989,000, as compared with £1,409,000 in 1928, an increase of over 30 per cent. Some way after comes Switzerland with £460,000, as compared with £364,000, and Sweden with £141,000, against £275,000, the import of Swedish vacuum cleaners having declined substantially, possibly owing to the increased manufacture in this country.

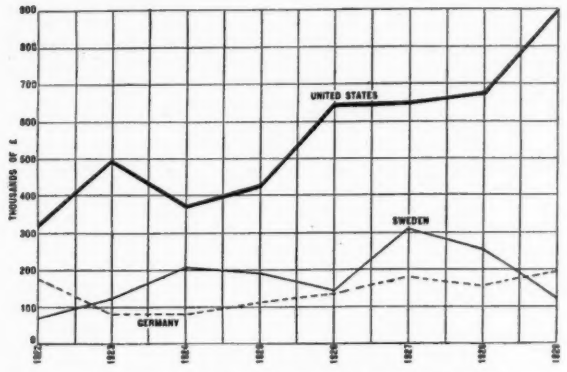


Fig. 7.—Origins of Imported Electrical Machinery.

The United States has a large item (£232,000) of d.c. motors to her credit, while her trade in vacuum cleaners (in contrast with Sweden's) has not fallen off from the previous year. Prominent amongst the imported German electrical goods and apparatus are radio apparatus, batteries, lighting accessories, and cables with insulation other than rubber. The United States also figures largely with radio apparatus and scientific instruments.

It may be added that in the trade in vacuum cleaners the heavy adverse balance shows no sign of decreasing. Imports as a whole were at the same weight level in 1929 as in 1928, and in value (at £579,000) only about £23,000 less. Exports were on the relatively low scale of £23,700, against an average of £37,000 in 1927-28.

With regard to d.c. motors, which apart from vacuum cleaners still constitute the largest item specified amongst imports of electrical machinery, there was a distinct increase, *viz.*, from £182,000 in 1928 to £289,000 in 1929. The totals for the past four years, together with the chief supplying countries, are shown below:—

	1926.	1927.	1928.	1929.
	(Thousands of £.)			
Total	192	210	182	289
Including from:—				
United States ...	105	144	124	232
Germany	19	15	18	22
France	3	18	6	11

Imports of a.c. motors were also rather greater in both weight and value than in 1928, *viz.*, 1,045 tons, value £156,000, against 995 tons, value £147,600. The United States, Sweden and Germany were the leading suppliers. In the import trade in generators there was also an increase on the whole, that in a.c. machines being due to a large item (£87,000) from Switzerland out of a total of £112,000, the latter figure comparing with an average total of £32,000 during the preceding four years. Imports of d.c. generators declined slightly.

The chief countries from which our imports of electrical goods and apparatus and machinery were derived are shown in figs. 6 and 7.

Electricity for the Home.

Heating and Ventilation: the Effect of Electric Fires on Enclosed Atmosphere.

By W. B. PARKER.

THE fact that the use of electric fires involves no combination, and therefore does not assist the ventilation by causing a current of air up the flue, has led some people to the conclusion that a room heated by electricity is less healthy than one heated by burning fuel. The effect on the electrical industry may easily be very harmful if such opinions are allowed to pass unchallenged.

The chief purpose of this article is to examine the difference in atmospheric conditions between rooms heated by electric fires and those heated by the combustion of some fuel at the base of a flue.

Purpose of Ventilation.

In order to examine the effects of any method of heating on the atmosphere of a room, it is first of all necessary to obtain a clear idea of the reason for the need for adequate ventilation and its function. Questioned on this point, the majority of people would reply with conviction that the purpose of ventilation was to replace the oxygen used up by breathing, and also to get rid of the carbon-dioxide exhaled. This popular view has been proved to be entirely erroneous. The reduction of the oxygen content of the atmosphere of even very badly ventilated buildings has been found to be far too small to cause the slightest discomfort. Moreover, carbon-dioxide (CO_2) is non-poisonous and is normally present in considerable amounts in the human lungs. It never accumulates, even in the stuffiest of rooms, in sufficient quantity to do any harm.

The feeling of discomfort in a stuffy room has been definitely established to be caused by the fact that the warm, moist, condition of the air interferes with the natural process by which the body regulates its temperature. This process operates by the opening and closing of the pores and by the regulation of the amount of perspiration. It is the evaporation of the perspiration from the skin which produces the requisite cooling effect on the body, and the moisture in the air of a stuffy room largely prevents this evaporation. This explains why an electric fan provides considerable relief in spite of the fact that it cannot reduce the temperature of the atmosphere, since it does not introduce any fresh air from outside. The current of air from the fan cools the skin by increasing the speed of evaporation of perspiration.

Dilution of Infection.

The chief danger to health in a stuffy room lies in the risk of the spreading of infectious diseases, especially the common cold and influenza. This is because the conditions in a close, warm, room are particularly favourable to the multiplication of bacteria. In addition, the resistance to infection of the lining of the nose, which is the natural defence against microbes breathed in, is greatly impaired by overheated air. In the opinion of Dr. C. W. Saleeby, who is an authority on such subjects, the chief purpose of ventilation is what he terms the " dilution of infection "—the effect of the interchanging air in carrying away the bacteria, thus reducing their density in the atmosphere.

The objections to electric heating on the ground of ventilation would probably never have been made if it were not for the fact that the complete closing of the flue is sometimes recommended when an electric fire is installed, in order to prevent loss of the convected heat. With the flue blocked and no other provision for ventilation, the interchange of air in an ordinary living-room would be entirely inadequate. To say that electric heating is unhealthy, because it is the only form of heating possible under such conditions, is absurd. The atmosphere in such a room would be unhealthy even if it were not heated at all. The room could be properly ventilated by means of an open window, but the advantage of the flue lies in the fact that it cannot ordinarily be closed. It is a mistake to suppose that a flue is ineffective as a means of ventilation unless combustion is taking place at its base. There is normally a considerable current of air up the chimney, usually sufficient to change the air in the room several times an hour.

Rate of Ventilation.

When a built-in gas fire of the usual type is installed the large flue area of the coal-grate is replaced by the considerably smaller outlet of the gas fire. The immediate effect of this is to reduce the normal current of air up the flue. When an electric fire is placed in front of the fireplace there is, of course, no such effect, unless the flue is closed, which is most undesirable. When the gas fire is in use there is the additional forced draught caused by the rising of the hot products of combustion up the chimney. This additional ventilation is, of course, strictly proportional to the amount of gas burned in the fire and, if this fact is considered, an interesting state of affairs comes to light. During the initial heating of the room, when there is the least need for ventilation, the gas fire is full on, thus providing maximum ventilation. When the room becomes comfortably warm and ventilation is more necessary, the gas fire is turned down, thus reducing the passage of air up the flue. If the room finally becomes too warm on account of the number of occupants, or through a rise in outside temperature, the fire is turned very low or out, thus reducing the ventilation to considerably less than it would have been if the gas fire were not blocking up a large portion of the flue. This objection may be advanced against any system of combined heating and ventilation in which the amount of ventilation is proportional to the heat input to the room, which is precisely what it ought not to be. Ideally, the rate of ventilation should be inversely proportional to the heat input. Since the necessary heat input to the room increases as the temperature of the air in the room decreases, this statement simply implies that the warmer the room the greater becomes the amount of ventilation necessary, which is obvious.

This leads one to believe that the ventilation provided by the gas fire is not quite so satisfactory as is claimed. In any case, the statement that a gas fire changes the air of the room a certain number of times an hour is valueless if it is based on the ventilation with the fire full on.

With the electric fire the conditions are entirely different. There is the continuous current of air up the unrestricted flue, and this current tends to increase as the room temperature increases, and is not directly affected by the heat output of the fire.

Air Sterilisation.

There is one other point which deserves examination, since it is peculiar to electric heating. This is the fact that the convected heat from an electric fire, which represents roughly one-third of the total heat output, is in the form of air which has been raised to a very high temperature by being passed over the red-hot elements and then cooled by being mixed with the rest of the air in the room. Since there is no combustion taking place, contact with the red-hot elements cannot alter in any way the chemical constitution of the air. The important effect it must have is to sterilise thoroughly the air so treated by destroying all the bacteria it previously contained. Since, as has already been shown, the chief purpose of ventilation is what Dr. Saleeby terms the "dilution of infection," the writer suggests that this sterilising effect should be investigated, since it may well prove to be an important advantage of electricity over all other methods of heating. Of course, this effect could never take the place of ventilation, although it might be a valuable adjunct to it. Ventilation is still necessary in order to prevent the humidity of the atmosphere from rising unduly, as this is the immediate cause of the discomfort experienced in a stuffy room. This sterilising effect cannot be obtained from any other source of heat, since other methods of heating without local combustion do not offer surfaces at a sufficiently high temperature.

Radiant and Convected Heat.

With regard to the vexed question of radiant *versus* convected heat, it is often overlooked that, if other conditions, such as ventilation and outside temperature, are equal, the ultimate rise in air temperature of a room will always be the same with a given heat input, whether it is in radiant or convected form. The great advantage of radiant heat lies in the fact that it is capable of producing comfortable conditions with a somewhat lower air temperature than when convected heat is relied upon exclusively. Radiant heat rapidly produces a feeling of warmth in the immediate vicinity of the source of heat, but it is not so effective for the more remote parts of the room. Since radiant heat can only warm the air indirectly by first of all warming the surfaces on which it falls, it follows that the whole room will sooner be comfortable if some of the heat is convected. In general, radiant heat alone becomes less satisfactory as the outside temperature falls, and this fact is recognised in countries with colder climates than ours. This leads to the conclusion that a combination of the two forms of heat proves the most effective in practice, and there certainly seems to be nothing wrong in this respect with the modern electric fire, which provides about two-thirds radiant and one-third convected heat.

Electricity on Shipboard.

The 25th anniversary of the Batti-Wallahs' Society was celebrated at the luncheon held on November 26th at the Hotel Metropole, London, W.C. As the Society was originally formed of ex-P. & O. electrical engineers, it was therefore most appropriate that the address to the members should have been given by the Rt. Hon. the Earl of Inchcape, G.C.S.I., the chairman of that line.

MR. W. MCLELLAND, C.B., O.B.E. (president), at the outset referred with suitable accompaniments to the presence of Mr. L. M. Waterhouse, founder of the Society, and also of Sir Hugo Hirst, Bart., whose birthday it was.

The EARL OF INCHCAPE said that within the region of mechanical research no problem was more vital to Great Britain as a maritime nation than the economical development of power for ships. He referred to the electrically-propelled *Viceroy of India*, which was placed in service last year, as having attracted more attention and comment than any vessel commissioned during the past half century. By comparison with the first oil-burning steamer in the P. & O. fleet, her turbo-electric installation had a capacity greater by 4,000 h.p. and consumed much less fuel; yet her total engine room complement was 19 less, or 100 less as compared with a coal-fired ship of the same size. Her steering qualities were considered to be of unique excellence, and her wireless equipment had given constant and practically world-wide communication. The advance of main turbo-electrical propulsion was not the only progress made, as the company had been able to dispense with a number of auxiliary electrical installations in several of its earlier ships through the introduction of new machinery worked by exhaust steam. In some instances the additional power from the exhaust amounted to nearly 6,000 h.p. per ship, the major portion of which was passed to the shafts and the remainder to small high-speed generators, embodied in the design of the new machinery, for lighting and heating purposes. He was proud to be reminded that the Batti-Wallahs' Society was founded in 1906 by a few P. & O. electrical engineers, who were among the first of their calling to go to sea in charge of ship's electric lighting. They found themselves designated by the Hindustani name of "batti-wallahs," which meant lamp men.

MR. J. S. HIGHFIELD proposed the vote of thanks to the chief guest, and the president in putting the proposal to the meeting mentioned that two electrically-propelled liners, larger than the *Viceroy of India*, were under construction.

MR. M. WHITGIFT (hon. secretary) announced that the next luncheon would be held on December 11th, when Sir Philip Dawson would, as chief guest, give an address on railway electrification.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.D.A.-E.L.M.A. Campaign.

The Shop and Display Lighting Campaign organised jointly by the British Electrical Development Association and the Electric Lamp Manufacturers' Association, officially ended on November 30th, though, doubtless, local activities will be continued. During the campaign a total of 12,000 shops have been surveyed; over 3,500 inquiries have resulted from the direct-mail literature, of which about 1,400 mention particular contractors; and more than 3,000 column inches of editorial matter has appeared in the trade and general Press. An indication that local activities are continuing, is afforded by the fact that five lecture-demonstrations were arranged for dates subsequent to the official termination of the Campaign, while a shop-lighting competition is to take place at Ashford next week. The mobile exhibition of electric signs has created a great deal of interest and has produced good results. Reports giving evidence of this have been received from Manchester, Bolton, West Hartlepool, Newcastle-upon-Tyne, Middlesbrough, Southport, Portsmouth, Northampton, Lewes, Birmingham, Bedford, Bath, Swansea, Cardiff, Sunderland, York and Battersea. The exhibition concludes its tour on December 8th with a visit to Clapham under the auspices of the County of London Electric Supply Co., Ltd.

An Orchestrated Trade Film.

The first all-talking orchestrated trade film was shown at the "Astoria" Cinema, Charing Cross Road, W.C., on November 25th before a distinguished audience, which included officials of Government departments, and members of the Cinematograph Exhibitors' Association and Projectionists' Guild. The film dealt with the manufacture of arc lamp carbons, cinematograph projection carbons, battery carbons and brush carbons. Every detail of the process was fully illustrated and explained. Mr. Charles H. Champion, managing director of the Ship Carbon Company of Great Britain, opened the proceedings by calling upon the Rt. Hon. C. A. McCurdy to introduce the film. In doing so Mr. McCurdy congratulated Charles H. Champion & Co., Ltd., upon their enterprise, and drew the attention of the audience to the fact that what British trade required was the fostering of the development of new industries rather than the expenditure of large sums upon bolstering up industries which in the very nature of progress must be regarded as moribund. The film, which bore the title of "Strike up Friend Ship," was then shown, and was well received by a large audience.

The Economic Mission to the Far East.

Referring to the British Economic Mission to the Far East, which arrived in Shanghai on November 30th, the correspondent of *The Times* in that city says that surprise has been expressed that the Mission "includes only one member interested in engineering, though machinery, metals, and minerals rank second in Chinese imports, and are items for which the demand is very progressive and must continue to grow, whether the tide of prosperity flows or ebbs.

The personnel of the Mission is mainly "textile" in character; the one engineering member referred to is Col. R. K. Morcom, chairman of Belliss & Morcom, Ltd., and a vice-president of the B.E.A.M.A.

The Bristol Electric Club.

We have received from Mr. F. R. Ashmead, hon. secretary of the Bristol Electric Club, a copy of the programme for the 1930-31 session. This includes an address to be given by Mr. J. W. Beauchamp on February 22nd, and the annual meeting which will be held on April 24th. We have also received a copy of the revised rules of the Club.

The Lighting of Public Buildings.

The last of the lectures in the twenty-second Illumination Design Course held at the Lighting Service Bureau, London, W.C.2, was given by Mr. R. W. Maitland on November 24th, his subject being "The Lighting of Cinemas, Hotels, and Public Buildings." It attracted a large audience, who listened with considerable interest to the lecturer as he took them over the vast field covered by his subject. In an attractive manner he dealt with the evolution of the cinema, the hotel, and the public building, bringing in quaint touches of history to illustrate his points. Many effective lantern slides added further interest to the lecture. The discussion was opened by Mr. Duncan, the well-known architect, and was continued by Mr. Bennett, another architectural authority.

The Illumination of Hastings Promenade.

The accompanying illustration shows the lighting of Hastings promenade, the material for which was supplied by the GENERAL ELECTRIC CO., LTD. The lanterns used along the promenade are the company's FB.3154 decorative panel type "Wembley" lanterns equipped with symmetric refractors and housing 750-watt "Osram" gasfilled lamps. Each standard is also fitted with two decorative lanterns of smaller type, and these are

G.E.C. Lighting at Hastings.

arranged for suspension from the existing scroll type brackets on the tram poles and carry 200-watt "Osram" gasfilled lamps with refractors. The resultant lighting is extremely pleasing, of high intensity, and glare is entirely avoided due to the diffusing exteriors of the lanterns which not only provide efficient lighting but are of decorative form. Altogether there are approximately 90 of the large and over 200 of the small lanterns erected.

Appliance Sales in America.

In spite of the general industrial and commercial depression in the United States, the International Hydro-Electric System, which controls large American and Canadian power undertakings, reports an increase in the sale of domestic electrical appliances by its subsidiaries. The increase for the first nine months of the current year amounted to 25 per cent. as compared with the corresponding period of 1929. Electric ranges, refrigerators, and washing machines, which constitute 65 per cent. of the total sales, showed an increase of 39 per cent., over 6,500 being sold in the nine months.

British Plant for Holland.

The Times reports that a special train left the works of Messrs. C. A. Parsons & Co., Ltd., Newcastle-on-Tyne, shortly after midnight on November 29th containing the second consignment of machinery ordered by the Provencial Electriciteitsbedrijf van Nord for the new power station at Velsco, Holland. Two Parsons 24,000-kW turbo-alternators were carried on the train, which was composed of 24 wagons. One of these was a well trolley wagon, weighing nearly 39 tons, conveying a stator of 65 tons, making a single wagon load of 104 tons, the heaviest ever loaded on the train ferry. The next in weight was an armour-plate wagon, of 31½ tons, carrying a piece of machinery weighing 37½ tons, making 69 tons in all. It was necessary to keep the railway track clear throughout the journey of 230 miles to Harwich.

A Christmas Window Display.

The question of seasonable Christmas window displays is just now in every trader's mind. Window dressers' ideas on this subject are inclined to become a little hackneyed; and to achieve an attention-drawing display it is necessary to depart from the customary string of coloured lighting strip and powder "frost" which have little sales force. The accompanying illustration demonstrates clearly the value of an intriguing background in presenting domestic merchandise. The contrast between the warm glow of the house on the back screen, the windows of which are illuminated from the

An "Ediswan" Christmas Window Display.

rear, and the "snow" in the foreground, which is flooded from the top of the window with daylight blue light, conveys the atmosphere of comfort. The suggestion is enhanced by the display of electric fires, toasters, irons and kettles in the foreground. This display was designed by the Publicity Department of the EDISON SWAN ELECTRIC CO., LTD., and a number have been produced for use in the windows of the company's numerous branches during the Christmas season.

Waste Prevention in Factories.

Even in the best regulated factories a certain amount of wastage is bound to occur, but there is no doubt that by the exercise of due care and thought quite an appreciable saving can be effected. With this point in view, STANDARD TELEPHONES & CABLES, LTD., has had the novel idea of organising a series of "Anti-Waste Exhibitions" at each of its three factories. These exhibitions are in no way held because of wastage in the factories has reached undue proportions, nor for the purpose of reproaching the company's employés for waste, but because it is felt that by showing them actual examples of how small actions of carelessness or thoughtlessness —though slight in themselves—can in the aggregate cost a considerable amount, the employés will realise the importance of the question and will co-operate in reducing that loss to a minimum. Arrangements have been made for all the employés of the company, including the office staff, to visit one or other of the exhibitions during working hours. The exhibits shown at each factory naturally refer to the particular products made there, but all typify wastage caused through such things as carelessness in manufacture, rough treatment, or the throwing away of useful material. At Woolwich the exhibits deal primarily with cable, while the exhibitions at Hendon and Southgate concern the manufacture of telephone apparatus and equipment; certain features, however, such as the wastage of stationery, are common to all three exhibitions. On entering the exhibition hall visitors are informed of the objects of the exhibition by means of a gramophone reproduction of a speech recorded by Mr. G. Hurford, the company's director of manufactures, who is responsible for the exhibitions. All the witty and artistic posters exhibited have been designed and executed by the company's staff. In connection with the exhibition, prizes are being offered to employés at each factory for the best suggestions for avoiding waste, and it is hoped that many interesting and valuable hints may be obtained.

Shop Lighting at Huddersfield.

The results of a survey of shop-window lighting in Huddersfield by Mr. W. M. Wilcox, head of the electrical engineering department of the Technical College, were recently published in the *Huddersfield Examiner*. Mr. Wilcox inspected no fewer than 2,558 windows; he found that about 36 per cent. of these had good lighting while 46.5 per cent. were classified as "bad." Only 9.5 per cent. employed electric signs and 5.5 per cent. external lights. Mr. Wilcox considers, however, that there has been a definite improvement since his last survey, in 1927.

The Marking of Imported Electric Lamps.

By an Order-in-Council dated July 13th, 1928, it was made compulsory for imported lamps to bear an indication of their origin indelibly marked upon the bulb, as well as upon the container. On June 2nd last the Board of Trade gave a Direction that the provision requiring the indication of origin to be indelibly marked on the bulb should not apply to electric incandescent lamps of ornamental design with bulbs to which, on account of their uneven surface, it was not practicable to apply the indication required by the Order, provided that they bore an indication of origin indelibly stamped, embossed, incised or impressed on the cap. The Standing Committee under the Merchandise Marks Act, 1926, having considered this Direction, and there having been no opposition, recommends that the Order be amended accordingly.

Siemens Bros. and an Austrian Company.

In our last issue we published a *Reuter* message from Vienna, in which it was stated that negotiations between Viennese financial establishments and Siemens Bros. & Co., Ltd., for the sale to the latter of shares held by the former in the "Elin" (Electrical Industry Co.) had been broken off. *Reuter* now states that the name of the Siemens firm referred to should have been given as Siemens-Schuckertwerke, Berlin, and not Siemens Bros. & Co., Ltd.

For Sale.

The North Metropolitan Electric Power Supply Co. has a 500-kW d.c. turbo-generator set for disposal.

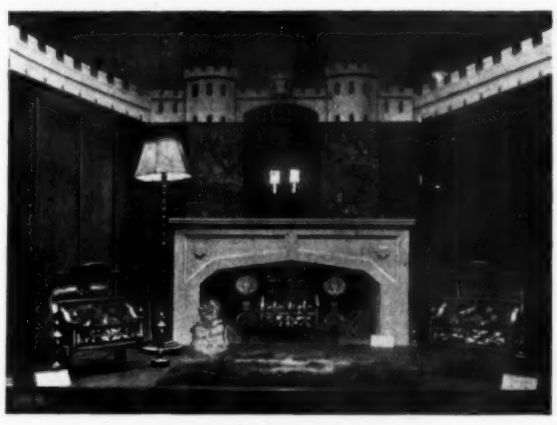
(See our advertisement pages to-day.)

The D.O.T. Foreign Samples Service.

It is not generally known that one of the aids to British manufacturers which the Department of Overseas Trade provides is a Foreign Samples Service by means of which manufacturers can gain an acquaintance with classes of goods which meet the demand in particular countries. For many years it has been the practice of the Department to obtain collections of such samples, and it is the Department's intention to continue and expand this service. The samples will be accompanied by detailed and informative explanatory reports as to market conditions, prices, foreign competition, &c., and will form part of a regular survey of overseas markets for British goods. The result of these investigations will be available to all British manufacturers and exporters of British goods. If desired, the Department, by means of its Foreign Samples Service, can obtain samples, or collections of samples, of special lines for particular firms. For this service the firms are expected to bear some portion of the actual cost of the samples obtained; or, if the firm requires exclusive use of the samples it will be expected to bear the full cost. By paying half the cost of samples (with a minimum of £1) a firm can obtain exclusive use of them for a reasonable period, after which they will revert to the Department for general use.

A Bradford Showroom Window Display.

An effective window display is shown in the accompanying illustration, which is one of Bradford Corporation Electricity Department's showroom windows, designed to give a special display of "Magicoal" fires. An interesting point of this



A Fire Display at Bradford.

display is that the dog grate and imitation tapestries are exact replicas of those in Haddon Hall. Mr. T. Roles, city electrical engineer, informs us that the show has proved a great success and has attracted a large number of people to the Department's showrooms.

Unemployment.

There was an increase of 24,210 in the number of persons on the registers of the employment exchanges in Great Britain during the week ended November 17th. At that date the total number was 2,285,987, as compared with 2,261,777 on November 10th, and 1,273,531 on November 18th, 1929.

D

Commercial Guides to Northern Africa.

The Department of Overseas Trade, from information furnished by its officers, has prepared some "Hints for Commercial Visitors to Egypt" which it will supply to interested British firms. As in previous publications of this nature, the booklet contains very full information regarding fares and routes, hotel accommodation, climatic conditions, regulations for commercial travellers, places of interest, mail arrangements, the postal services, and general notes. The Alexandria Consular District and Port Said are given separate attention.

A similar publication for the guidance of visitors to Algeria, Tunisia, Tripolitania and Cyrenaica, has also been prepared by the Department.

Trade Announcements.

ELECTROMERSIBLE MOTORS & PUMPS, LTD., Abbey House, Westminster, S.W.1, has acquired the goodwill, drawings, patterns and data of Submersible Motors, Ltd. (in liquidation), together with the "Reed Cooper" patents relating to submersible motors and pumps, and has opened new works for the production of patent submersible pumping equipments. We have received an illustrated pamphlet dealing with the "Reed Cooper" "Electromersible" pump.

MR. A. TREBILCOCK WHITE has opened an electrical service station at Tregolls Road, Truro, for the servicing and repair of electrical machinery, armature winding, instruments, magnetos, batteries, &c.

Drake & Gorham's Acton Works.

New works have recently been opened by Messrs. DRAKE AND GORHAM, LTD., at Standard Road, Park Royal Road, North Acton, N.W. The building is of the latest construction for hygienic comfort to the employés, and modern machinery and travelling cranes have been incorporated. The accompanying illustrations show exterior and interior views of the works, the interior view being of the l.p. and h.p. switchgear workshop.

The New Works of Messrs. Drake & Gorham, Ltd., at Acton.

Social Events.

The Operatic Society of the British Thomson-Houston Co., Ltd., recently successfully produced the Gilbert and Sullivan opera, "The Yeomen of the Guard," which was given nightly for one week at the Prince of Wales Theatre, Rugby. Admirably staged and acted, the production did the greatest credit to all concerned, both in the limelight and behind the scenes, the crowded houses at each of the seven performances testifying popular enthusiasm.

Henley's Dramatic Club is presenting "Kick In," a "fascinating and thrilling drama of the New York underworld," at the Cripplegate Theatre, E.C.1, on Monday evening next, December 8th.

The Buenos Aires Exhibition.

BAKELITE, LTD., 68, Victoria Street, S.W.1, informs us that it is exhibiting at the forthcoming British Empire Trade Exhibition, Buenos Aires, although its name did not appear in the official preliminary list of exhibitors, from which we quoted in our issue of November 21st.

Book Notices.

The 1931 edition of "*The Wireless and Gramophone Trader* Year Book and Diary" contains a new 16-page feature entitled "Practical Service Methods" dealing with the broad principles involved in the service work which the dealer is normally called upon to perform. It covers the most economical and up-to-date methods of dealing with repair, service and constructional jobs upon installations, accessories and receivers. The trade directory portions are as usual printed on various tinted papers for ease of reference and they include lists of manufacturers: manufacturers' agents and wholesale factors, with their addresses and telephone numbers; proprietary names of wireless and gramophone goods and their makers; and a buyer's guide giving an alphabetical arrangement of many hundreds of different classes of wireless and gramophone goods listed with the names of their suppliers. All the technical wireless and gramophone data and broadcasting information has been revised. The book is published by the Trader Publishing Co., Ltd., at 5s. 6d., post free (special price of 3s. 6d., post free, to subscribers to "Trader" journals).

"Manuale Pratico di Telegrafia Sottomarina (Cablografia)," by Ing. Italo de Giuli. Pp. xii+384; 146 illustrations and 26 tables. Milan: Ulrico Hoepli. Price 30 lire. Even without a knowledge of Italian, readers will readily gather that this little work is a practical manual on submarine telegraphy, and as Ing. de Giuli, the author, is the manager of the Italian Submarine Telegraph Cable Co. (Italcable), it may be taken for granted that the information it contains is of an up-to-date character. From the preface we learn that his purpose has been to provide the staff of cable companies with some knowledge of the electrical principles involved in submarine telegraphy and of the apparatus used in connection therewith. The book is divided into five chapters, the first of which deals at length with cable-telegraphy and cable telegraph instruments; the second is devoted to a description of a typical submarine cable and its associated equipment; the third deals with the resistance, insulation, capacity, e.m.f., and other measurements; the fourth with multiple telegraphy, and the last one with loaded cables. The various sections are well illustrated, some of the drawings being to a large scale and inserted in the book as separate folded sheets.

The new catalogue of the Popular Mechanics Press, Chicago, Ill., contains over a hundred pages and includes extensive sections relating to all branches of electrical and engineering subjects.

We have received from Mr. A. F. Williamson, electrical engineer of the Public Works Department, Western Australia, a list of electricity stations in Western Australia. The information contained in the list includes the name of the supply authority, the type and capacity of the plant installed, system of supply, output, and the charges for the various classes of supply.

Polish Foreign Electrical Trade.

The *Board of Trade Journal* shows that during September Poland imported "conductors, apparatus, and other electro-technical materials" to the value of 5,436,000 zloty (£125,000). Polish exports of this class were valued at 101,000 zloty (£2,300).

Cable Makers and Bolton's.

The *Financial News* reports that British Insulated Cables, Ltd., and Callender's Cable & Construction Co., Ltd., have acquired an interest in Thomas Bolton & Sons, Ltd., copper smelters and manufacturers, Widnes, with representation on the board of that company.

Electrical Activity.

The B.E.A.M.A. Index of Electrical Activity, quoted by the *Board of Trade Journal*, gives a figure of 98.8 for October (1924=100), as compared with 108.3 for September and 111.5 for October, 1929.

New Catalogues and Lists.

ISENTHAL & Co., LTD., Ducon Works, Victoria Road, North Acton.—A comprehensive illustrated and priced list (No. M.1030) of mercury switches and relays for industrial and laboratory control.

PHILIPS LAMPS, (A/SIA), LTD., 69-73, Clarence Street, Sydney, Australia.—A photographic lamp chart, a pamphlet on street lighting and copies of the "Philips Lamplighter"; also plans and specifications of a miniature golf course lighting system.

The ELLMAR MOULDINGS Co., Thimble Mill Lane, Birmingham.—Brochures illustrating in colour examples of "Ellmar" bakelite mouldings.

THOMPSON & Co., 1 and 3, Old Swan Lane, London, E.C.4.—An illustrated booklet dealing with "Rex" electricity meters and tariff time switches for single- and three-phase a.c.; also prices and particulars of the "S.E." cable joint.

SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., 30-34, New Bridge Street, London, E.C.4.—Leaflets giving particulars of small automatic telephone equipment and of the "Walligraph" extension arms for telephones and electric lights.

JOHN MOORES & Co., Ravald Street Works, Salford.—A 72-page catalogue, illustrating and describing the 1930-31 season's wireless apparatus and radio-gramophones.

PREMIER ELECTRIC HEATERS, LTD., Keeley Street and St. Andrew's Road, Birmingham.—A Christmas folder (list No. 151) relating to "Premier" domestic appliances.

The DRAYTON REGULATOR AND INSTRUMENT Co., LTD., West Drayton, Middlesex.—An illustrated brochure relating to "Drayton" steam traps.

The IGRANIC ELECTRIC Co., LTD., 149, Queen Victoria Street, London, E.C.4.—A leaflet describing the "Universal" mains transformer for radio receivers.

The BRITISH THOMSON-HOUSTON Co., LTD., Crown House, Aldwych, London, W.C.2.—A folder containing the prices of "Mazda" lamps.

WALKER BROS., LTD., Quality House, Temple Row, Birmingham.—The December issue of the "Electrical News" containing an article entitled "The Christmas Present Problem Solved by Electricity."

GEORGE HUMPHREY, 25b, High Street, Wimbledon, S.W.19.—A circular letter regarding the "Community Service" fuse-wire holder, with a sample.

The GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, London, W.C.2.—A well-illustrated brochure (F.5497) describing the G.E.C. dock-lighting systems carried out for the Port of London Authority; also the November issue of the "Osram Bulletin," containing articles on the Blackpool illuminations, the lighting of municipal buildings, Christmas gifts, lighting a university lecture theatre, radio transmission and reception from aircraft, &c.

The WORKINGTON IRON & STEEL Co., Moss Bay, Workington, Cumberland.—A brochure giving details of the "Uco" all-mine cylinder irons; several pages of graph paper are included.

The MARCONIPHONE Co., LTD., 210-212, Tottenham Court Road, London, W.1.—Copies of circular letters which are being distributed to dealers in connection with the Christmas sales campaign.

DRAKE & GORHAM, LTD., Standard Road, Park Royal Road, North Acton, London, N.W.10.—List No. 103, giving details and illustrations of e.h.p. sub-station switchgear.

MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A leaflet (391/2), illustrating the salient points of "M. & C." lighting fittings for mining service.

W. E. BEARDSALL & Co., LTD., Victoria Bridge, Manchester.—A list showing in colour an attractive range of "Nuglaze" and "Satinoid" lighting shades.

HOLOPHANE, LTD., Elverton Street, Vincent Square, London, S.W.1.—List No. 222, giving particulars of the new "Hedralite" system of lighting fitting construction.

HAILWOOD & ACKROYD, LTD., Morley, near Leeds.—Leaflet G.W. 128/1, showing an artistic and modern range of "Hailware" etched shades, globes, flambeaux, fittings, &c.; also leaflet H.W. 36/1, illustrating Hailwood's patent built-up table lamps.

The SAXON RADIO Co., Henry Street Works, Blackpool, Lancs.—The autumn number of the "Saxon Recorder," which describes "Davidson" fires and accessories, "Challenger" radio receivers, the "Saxon" all-wave tuner, loud-speakers, radio-gramophone apparatus, &c.

Uruguayan Government Contracts.

The British Vice-Consul at Montevideo has furnished particulars of the conditions regulating the award of Government contracts by means of tenders. A copy of the memorandum which has been prepared on the subject may be obtained by United Kingdom firms interested in the supply of British goods, on application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference No. C.X.3400.)

The Jugo-Slavian Market.

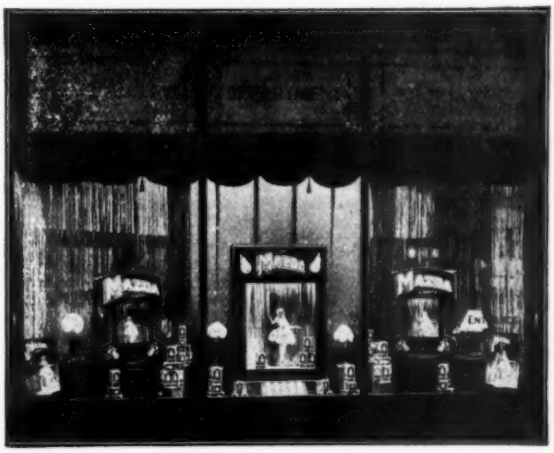
In a recent review of the electrical situation in Jugo-Slavia, *Commerce Reports* says that five European and internationally-known firms control the electro-technical market in the country, operating through subsidiary firms with branches in the principal towns. There are in addition a number of firms of minor importance, especially as regards appliances such as cooking utensils, irons, percolators, and fans. All the European concerns maintain considerable stocks of the products they manufacture and therefore are in a strong position. There is considered to be little prospect for the sale of American appliances as the European manufacturers are able to quote prices for plant and appliances some 20 per cent. lower than the American prices.

Crompton Lamp Publicity.

Although CROMPTON PARKINSON, LTD., took over the Nox Electric Lamp Co. on the eve of the lamp sales season, a complete range of publicity matter was prepared in a short time and has now been available for several weeks. The new carton illustrates the full range of lamps in the form of a continuous design on the four sides, so that by arranging the cartons suitably, a frieze effect can be obtained which is most useful for window dressing. A window display piece which is provided measures about 40 in. wide by 30 in. high. It is reproduced in full colours and features the blue which has been adopted for all Crompton lamp publicity. The centre piece is supported by wings representing cartons, thus harmonising with any cartons used elsewhere in the window. A cut-out displays the Crompton slogan in a perspective effect, and is arranged to take an illuminated pearl lamp. Other publicity matter includes a small cut-out for insertion into the top of a carton, stamps bearing the slogan for use in correspondence, and counter pamphlets.

A "Mazda" Lamp Display at Barnsley.

A display of lamps provide by the BRITISH THOMSON-HOUSTON Co., LTD., was recently given at the electricity showrooms of the Barnsley Corporation. The window was well arranged and at night (when the accompanying illustration was taken)



A "Mazda" Window Display at Barnsley.

attracted considerable attention. The display was lighted by 36 100-watt colour sprayed "Mazda" lamps in red, blue and amber, and ten 100-watt pearl lamps.

Bankruptcy Proceedings.

F. W. HODGES, 9A, Station Hill, Kidderminster, electrical engineer.—The receiving order in this matter was made on the debtor's own petition on October 30th. According to the statement of affairs lodged there are liabilities amounting to £528 and assets totalling £217, leaving a deficiency of £311. The debtor commenced business on his own account as an electrical engineer in 1926, with £185 borrowed from his mother. The trading was successful for about two years, when he experienced difficulty owing to competition and lack of capital. At this time he had considerable debts due to him which he has been unable to collect. In addition to his retail trade in electrical and wireless accessories and sets, he had done electrical installation work, but owing to many accounts being unpaid and irrecoverable, losses were sustained. For the past two years he had extended his installation work which had resulted in his leaving the shop to an assistant, and he had lost custom in the retail business. He had a further loan from his mother which was used towards meeting overdue accounts, and during 1930 a bank overdraft up to £50 was arranged. An execution was levied in March, 1930, but this was paid out. The only other execution levied was on October 8th, 1930, at the suit of his principal trade creditor. The debtor's stock-in-trade has been sold by the sheriff under the execution. Debtor attributed his failure to depreciation of stock; bad debts; expenses of illness; and profits insufficient to cover expenses, consequent on competition and general depression. The following are creditors:—

	£		£
Hodges, Mrs. S.	220	Electric Trades Supply	56
Z Electric Lamp and Supplies Co., Ltd. ...	138	Robinson and Hands Elec. Co., Ltd.	30

H. A. KAPLAN, radio dealer, lately carrying on business at 37, Lisle Street, Leicester Square, W.C., as "The London Surplus Depôt."—This debtor attended before Mr. Registrar Warmington at the London Bankruptcy Court last week for public examination upon accounts showing liabilities of £610 against assets of 3s. Replying to the Official Receiver, the debtor said he began business in 1923 under the style of the "Elkay Wireless Company" and 12 months later formed H. Kaplan,

Ltd., but after another four months sold his interest in the concern for £50 in cash and stock. He next formed Standard Accessories, Ltd., to carry on business as wireless factors, but that company went into voluntary liquidation a year afterwards. In April, 1929, he began business in partnership at 14, Lisle Street, in the name of the "West End Surplus Stores" and five months later retired with a consideration of £50 to start a similar business at 37, Lisle Street, under the style of the "London Surplus Depôt." The trading was not successful, and a branch shop also proved a failure. In March he formed London Surplus Depôt, Ltd.; he received 201 shares and became a director. That company took over his assets but not his liabilities and it went into voluntary liquidation in June, to which failure, combined with insufficient capital and severe competition, he attributed his insolvency. The examnation was concluded.

L. O. RICHARDSON, electrical engineer, 205, Railton Road, Herne Hill.—The public examination of this debtor was held on November 25th at the London Bankruptcy Court, the accounts showing liabilities of £239 and assets "bad book debts" about £8. The debtor said that he began business in June, 1929, and traded successfully until the following December, when he lost two contracts. In April last he was pressed by creditors, who subsequently obtained judgment against him; two months later he ceased to trade, after executions had been levied, and bankruptcy proceedings instituted. The debtor attributed his insolvency to lack of capital, trade depression, and to the profits of the business being insufficient to meet his drawings. The examination was concluded. The following are creditors:

	£		£
Lithanode Co., Ltd. ...	99	Mullard Wireless Service Co., Ltd.	33
Sphinx Electric Co., Ltd.	24		

F. J. JERVIS and W. H. POLLNER (trading as "The Abbey Radio Service"), 1, Blenheim Passage, St. John's Wood, N.W. —The public examination of these debtors was held on November 27th at the London Bankruptcy Court, the accounts showing liabilities of £334 against assets of £178. Questioned by Mr. Wheeler, Assistant Official Receiver, the debtor Jervis said that they started business as radio engineers in March, 1930, under the above style, with stock of £100 and a cash capital of £55 borrowed from a relative of his partner. The trading was fairly successful, but was handicapped by lack of capital and price-cutting competition. In September they filed their petition because they were being pressed by creditors. The failure was further attributed to trade depression. The examination was concluded.

W. V. OWEN, 1, Church Street, Tremadoc, late of Portmadoc, Carnarvonshire, electrical engineer.—The receiving order herein was made on the debtor's own petition. At the first meeting of creditors held recently at the Official Receiver's office, Chester, the case, being a summary one, was left in the hands of the Official Receiver, as trustee.

W. L. KELSHAW, electrical engineer, 168, Baslow Road, Totley.—First meeting held December 3rd at the Official Receiver's Offices, Figtree Lane, Sheffield. Public examination, December 11th at the County Court Hall, Bank Street, Sheffield.

J. P. HAYES (Evening World Radio Gram. Stores & Service), radio electrician, 17, Lawrence Hill, Bristol.—Last day for receiving proofs for dividend December 9th. Trustee, Mr. H. Ashton, 26, Baldwin Street, Bristol, Official Receiver.

J. A. HENDERSON, electrical contractor, 28a, Basinghall Street, E.C.—First and final dividend of 2d. in the £, payable December 1st at 44, Gresham Street, E.C.2.

J. G. RITCHIE, electric lamp dealer, 54, Woodsley Road, Leeds.—Public examination, adjourned *sine die*, to be proceeded with on December 16th.

A. WILLIAMS, electrical engineer, 16, Hauteville Court, Stamford Brook, London.—Trustee, Mr. R. B. Petre, 11, Ironmonger Lane, E.C., released October 30th.

G. BLACKMORE, wireless engineer, 62, Coventry Road, Market Harborough.—Last day for receiving proofs for dividend, December 13th. Trustee, Mr. E. Barlow, 1, Berridge Street, Leicester, Official Receiver.

J. BAINTON, electrician and radio engineer, 86, Wheelock Street, Middlewich.—Last day for receiving proofs for dividend, December 15th. Trustee, Mr. C. J. Pyke, 12, Lonsdale, Street, Stoke-on-Trent, Official Receiver.

NORTON ELECTRIC CO., wireless manufacturers, 17, Norton Folgate, E.1.—Receiving order made November 26th on a creditor's petition. First meeting, December 9th, and public examination January 23rd, both at Bankruptcy Buildings, Carey Street, W.C.2.

Company Liquidations.

DUNHAMS, LTD., radio and electrical engineers, 7, New Wharf Road, N.1.—The statutory meeting of creditors was held on November 24th in London. The shareholders had already passed a resolution nominating Mr. Jarvis, of Messrs. Philip Mordant, Jarvis & Co., as liquidator. A statement of affairs submitted disclosed liabilities of £4,115, of which £2,570 was due to trade creditors; and the Vulco Dry Battery Co., Ltd., and C. S. Dunham were loan creditors for £794 and £751, respectively. The net assets were £1,056, leaving a deficiency of £3,059. Mr. Jarvis said that the company was formed last year to take over a business which had been previously carried on by Mr. Dunham. The business was a prosperous one, and at that time there was an excess of assets over liabilities of £3,000. The principal reason for forming the company was to obtain additional capital. The appointment of Mr. Jarvis as liquidator was not confirmed, and the meeting was adjourned for a week. The following are creditors:—

	£		£
Vulco Dry Battery Co.	1,553	Symphony Gramophone & Radio Co., Ltd.	80
C. S. Dunham	750		
Temple Advertising Co.	236	National Accumulator Co., Ltd.	67
Marconi's Wireless Telegraph Co., Ltd.	231	Strakers, Ltd.	48
A. C. Cossor, Ltd. ...	156	Williams & Moffatt, Ltd.	40
Edison Swan Electric Co., Ltd.	93		

MAESTRO RADIO GRAMOPHONE CO., LTD.—A meeting of members will be held on December 30th at 30, St. Ann Street, Manchester, to receive a report of the winding up of the company by the liquidator, Mr. H. R. Hayes.

MILLS ENGLISH ENGINEERING CO., LTD.—First and final dividend of 1s. 0¼d. in the £, payable December 12th at the office of the liquidator, 35, Windsor Place, Cardiff.

ARTIFICIAL SUNLIGHT, LTD.—Winding up voluntarily. Liquidator, Mr. C. W. Wildy, "Wyss Wood," Kenley, Surrey.

MAY & PADMORE, LTD.—Particulars of claims by December 31st to the liquidator, Mr. C. H. Smith, 84, Colmore Row, Birmingham.

GRAVESEND & NORTHFLEET ELECTRIC TRAMWAYS, LTD.—A meeting of members will be held at 88, Kingsway, W.C.2, on December 30th to receive a report of the winding-up of the company by the liquidators, Mr. T. Bower and Mr. T. H. Underhill.

Private Arrangements.

T. KAY, electrical engineer, 176, North Road, Preston.—A meeting of creditors was held recently at the offices of Messrs. Clark, Clarkson & Howarth, Preston, when a statement of affairs was submitted which showed ranking liabilities of £1,176 and net assets of £402, leaving a deficiency of £774. The debtor commenced trading as an electrician in 1925. In 1927 he entered into partnership with another, but a dissolution took place in 1929, and all the liabilities existing at that time were paid off. Recently creditors had pressed and an execution had been levied for a small amount. A resolution was passed in favour of a deed of assignment being executed to Mr. Clarkson as trustee. A committee was also appointed. The following are creditors:—

	£		£
Varley, T.	46	Stearn Electric Co., Ltd.	54
Clarke, Clarkson and Howarth	54	General Electric Co., British Insulated Cables, Ltd.	40
		Nutter, Son & Edge ...	56

The Market for Refrigerators in Chile.

Owing to the increasing number of houses being erected in the fashionable quarters of large towns and the opening of new hotels and restaurants, reports *Reuter's Trade Service*, the demand for electrically-operated refrigerators has notably increased of late and sales promise to be larger than usual during the coming hot season. December, January and February are the summer months in Chile, when ice is considered not so much a luxury as a necessity, and most families, even middle-class, install refrigerators. It is estimated that the use of ice safes has more than trebled during the past five years. A device combining simplicity of operation with automatic control, offered at a reasonable price, would, it is thought, have a good chance on the Chilean market. In order to avoid transport and customs charges, the local production of refrigerators is being encouraged.

Recent Contracts.

An important contract recently received by the ENGLISH ELECTRIC CO., LTD., is for twelve pairs of equal-wheel tramcar trucks, complete with motors, for Liverpool. The order is the outcome of the satisfactory operation of a sample pair of trucks of the special design which was developed by the engineer of the Liverpool tramways, in collaboration with the English Electric Co. A special feature of the trucks is that the motor frame is utilised as the basis of the truck, the motor being mounted between the wheel axles and at right angles to them. The armature shaft is extended at both ends and carries the driving pinions, the latter engaging with a helical bevel wheel mounted on a quill which surrounds the axle. This arrangement reduces the unsprung weight to that of the wheels, axles, and axle bearings; as, moreover, the motor and quills are fitted with ball bearings and the lubrication of the drive is by oil baths in dust-proof housings, wear and tear, and noise and maintenance are greatly reduced. Only one oil-filling aperture at each end of the truck is provided, instead of some twenty-eight filling points as on a four-motor standard

bogie car. The order includes control equipments of the foot-operated electro-pneumatic type for the twelve cars. The total value of the contract is about £25,000.

Messrs. RUSTON & HORNSBY, LTD., Lincoln, have secured an order for an additional six-cylinder vertical oil engine for the Jerusalem power station. Three 450-b.h.p. "Ruston" airless-injection engines were ordered for this undertaking at the beginning of 1929, and the engine now ordered is required for the extension of the station.

The new Bibby motor vessel *Worcestershire* is being equipped by the MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD., with Marconi valve transmitting and receiving apparatus for long and short wave-lengths; a lifeboat set and searchlight; and a Marconi direction finder.

Prices of Materials.

Messrs. Edward Till & Co. report, December 2nd: India-rubber, Para fine, no change.

Messrs. James & Shakespeare report, December 2nd: Copper bars (best selected), sheet and rod, no change. English pig lead, £17 5s., 5s. dec.

Messrs. F. Smith & Co. report, December 2nd: No change in the prices of electrolytic copper and silicium bronze wire.

Messrs. James Forster & Co., reporting on November 29th, stated that little interest was shown in the lead market last week by consumers or speculators. Opening slightly firmer on Monday, prices since remained steady. Arrivals were extremely heavy last month, 27,000 tons having been already imported, making an average for the past three months of nearly 30,000 tons a month. This, of course, is far in excess of consumption, and stocks in this country during that time must have materially increased.

Lighting and Power Notes.

Australia.—ELECTRICAL DEVELOPMENT IN VICTORIA.—Included in the public works to be carried out under a system of local loans in the State of Victoria during the coming year is £1,160,000 for electrical development. The Victorian Electricity Commission is to take over that part of the service of the River Latrobe Hydro-Electric Co. in Warragul and district and is to spend £17,000 in improving the system.

Bedford.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £5,000 for transformers and £10,000 for apparatus for hire.

Brighton.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £1,000 for sub-station equipment in connection with the supply of electricity to the Equitable Co-operative Society's premises in London Road.

Bury.—YEAR'S WORKING.—We have received from Mr. J. G. Potts, engineer and manager of the Corporation Electricity Department, a copy of his report, together with a statement of accounts, of the undertaking for the year ended March 31st last. There was an increase from £125,693 to £128,187 in the total revenue, the working expenditure rising from £70,802 to £77,327. A sum of £6,126, as against £12,759 in the previous year, was contributed to capital expenditure, which left a gross profit of £44,735 (£42,132). To this was added income from other sources, making a total of £46,316 available. Interest on loans absorbed £19,845, sinking fund contribution £20,636, and bank interest £744, and there was a net surplus of £5,091, as compared with £6,669 in 1928-29. During the year capital expenditure amounted to £59,777, the chief item being £41,569 for plant and machinery at the Chamber Hall power station; the total spent on the undertaking now stands at £725,211. Electricity sold increased from 27,232,015 to 29,634,287 kWh, and the maximum supply demanded from 12,320 to 12,440 kW. The average price obtained per kWh fell from 1.060d. to 0.988d. During the year 744 consumers were connected, making a total of 5,224. The 10,000-kW extension at the Chamber Hall station was completed and officially started up on March 12th last.

Canada.—PROGRESS DURING 1928.—During the year ended December 31st, 1928, the output of Canadian central electric stations increased by 12 per cent. to 16,337,804,000 kWh, of which commercial stations generated 11,460,974,000 kWh and municipal stations 4,876,830,000 kWh. Capital invested in the industry rose in 1928 to $956,919,603, covering a total installation of 4,627,667 h.p. out of the total water power development in Canada aggregating 5,727,162 h.p. Revenue received by the operating companies or municipalities amounted to $112,326,819, and expenses totalled $62,330,860. The total pole-line mileage was 37,333, and the number of customers served 1,464,005, including 1,207,457 domestic consumers and about 250,000 commercial consumers of light or power.

OTTAWA RIVER POWER DEVELOPMENT.—The Ontario Hydro-Electric Power Commission is now co-operating with the Ottawa Valley Power Company in the development of electrical energy at Chats Falls on the Ottawa River, where 224,000 h.p. is to be developed. Construction works on the Ontario side of the river are being carried out on behalf of the Hydro-Electric Power Commission of that province, the company and the Ontario Hydro-Electric Power Commission having mutually agreed that each is entitled to utilise one-half of the water power available. The power house of the Ottawa Valley Power Company on the Quebec side of the stream is to be equipped with four 28,000-h.p. units, and a similar power house will be situated on the Ontario side.

Central Sussex.—BULK SUPPLY FROM BRIGHTON.—A bulk supply of electricity from the Brighton Corporation's generating station at Southwick has now been made available to the Central Sussex Electricity, Ltd., which supplies Haywards Heath and district.

Chelmsford.—CHANGE-OVER.—The Town Council has consented to an application by the Electric Supply Corporation, Ltd., for consent to the change of the system and pressure of the electricity supply in the borough from 2- and 3-wire, 100 cycle, a.c., at 100, 200, 240, 400, and 480 V, and 2-wire, d.c., at 110 V, to 50-cycle, a.c., at a pressure of 230 V single-phase and 400 V three-phase. The Electric Supply Corporation, Ltd., stated that a reduction in the price of power was promised when the change of the system and pressure of supply had taken place.

China.—COMPENSATION FOR PRIVATE ELECTRICAL UNDERTAKINGS.—The *Chinese Economic Bulletin* states that in order to safeguard the interests of private electrical enterprise throughout the country, the Executive Yuan, in a circular order to the various Provincial and Municipal Governments, instructs that in future full compensation must be paid by the local authorities to private electrical undertakings for electricity supplied for street lighting or other public purposes. It is pointed out that the refusal on the part of some local Governments to give due compensation has entailed serious financial losses upon the private companies concerned, which accounts partly for the fact that during the past few years, over ten private electrical undertakings have been compelled to suspend business. This action, the order emphasises, is not only diametrically opposed to the Government's policy of protecting and encouraging private enterprises but also constitutes a violation of the Regulations governing Government Supervision of Private Electrical Enterprises, which call for the payment of full compensation in all instances.

Congleton.—EXTENSIONS.—The Town Council has applied for sanction to a loan of £11,750 for the laying of cables and the provision of a transformer and kiosk in connection with the electricity extension scheme in the borough.

Continental.—FRANCE.—Following the recent inauguration of the first large 220-kV transmission line which the Rhenish-Westphalian Electricity Works Company has provided for the exchange of electricity between the thermal power stations in Rhenish-Westphalia and the hydro-electric stations in the Alps, a second scheme of the same kind and at the same pressure is at present being considered, with the object of supplying the northern departments of France, and the city of Paris in particular, with power from the hydro-electric stations in the south of the country. The transmission line is intended to stretch from the stations of the Truyère in the central mountains of France as far as Paris, a distance of 325 miles. No fewer than seven electricity generating concerns have joined together to form the "Société pour le Transport de l'Energie Electrique du Massif Central" with the object of carrying through the scheme.

The Société des Forces Motrices de la Vienne is erecting three hydro-electric power stations on the River Taurion, near Limoges. The first of these, that known as St. Marc, which has a capacity of 18,000 h.p., is approaching completion and is about to be put in operation. Further up the river a second station, known as the Chatelus, is well in hand, its capacity being 12,000 h.p. The third station, the Chatre, lies between the two; it will have a capacity of 9,000 h.p., and is expected to be completed early in 1932.

Coventry.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £2,777 for the purchase of a sub-station site and for mains.

Dudley.—FLOODLIGHTING OF CASTLE.—The Corporation Estates Committee has informed the Dudley and District Chamber of Commerce that it would consider the suggestion of floodlighting the Dudley Castle keep if the Chamber of Commerce were prepared to contribute towards the cost.

Eastbourne.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend the h.p. main in the Welcome district and erect a temporary sub-station feeding point in order to improve the pressure of the supply, at a cost of £1,433.

Fleetwood.—RESTRICTED SUPPLY.—Electricity consumers in Fleetwood have been asked to restrict their consumption between 4 and 6 p.m. during the next two months. At a recent meeting of the Town Council it was stated that in 1929 the Electricity Committee's application for a loan of £12,500 for extensions was refused by the Electricity Commissioners, who said an adequate supply would be available from the grid this winter. The Board had met with difficulties in obtaining permission to carry wires overhead, and the supply was consequently not forthcoming.

Gloucester.—ELECTRIC COOKERS.—The City Council has applied for sanction to a loan of £1,000 for electric cookers.

Hull.—PUBLIC LIGHTING.—The Corporation Works Committee recommends that sanction be obtained to a loan required in connection with a scheme of public lighting by electricity. To complete the scheme, 5,183 standards, costing approximately £45,351, will be required. Allowing for normal street development during the carrying out of the work, the total cost is estimated at £67,566.

Inverness.—MORE PLANT REQUIRED.—Members of the Town Council recently inspected new generating plant at the electricity works and also the converting plant in the sub-stations. It is stated that in spite of this new plant which has just been put into service, the demand for electricity is increasing so rapidly that more generating plant will have to be installed almost at once.

Lanchester.—STREET LIGHTING SCHEMES.—The Rural District Council proposes to have electric street lighting installed in the village of Lanchester, Castleside, and the Delves Knitsley.

Lerwick.—ELECTRICITY SCHEME.—The Town Council has decided to take preliminary steps towards obtaining a Provisional Order for a £12,000 electricity scheme. The Unemployment Grants Committee has offered a grant of 50 per cent. of the interest payable on the money borowed.

Loch Ericht.—HYDRO-ELECTRIC SCHEME COMPLETED.—The Grampian Electricity Supply Company's scheme for utilising the waters of Loch Ericht for the generation of electricity, was inaugurated last Sunday, Mr. George Balfour, M.P., chairman of Messrs. Balfour, Beatty & Co., engineers and contractors to the company, performing the ceremony. The system is now linked up with the Central Electricity Board's system at Abernethy. The work in connection with the undertaking has cost £1,750,000 and has taken just over two years to complete.

London.—BATTERSEA.—**The Borough Council Electricity** Committee is applying for sanction to loans of £48,000 for mains and services and £2,037 for switchgear.

Manchester.—LOAN.—The Corporation is applying for sanction to a loan of £30,000 in connection with consumers' sub-stations.

CHANGE-OVER AT HOSPITAL.—The Corporation Health Committee reports that, in order to conform with the new standard a.c. supply now being adopted in Manchester, it is necessary to make some alterations in the supply to the Withington Hospital and Institution. The total cost of the proposed alterations is estimated at £4,500.

Retford.—PRICE REDUCTIONS.—The charge for electricity for lighting is to be reduced from 8d. to 6d. per kWh in the borough, and from 10d. to 8d. per kWh in the rural district. For heating and cooking the prices will be 1½d. and 1¾d. per kWh, respectively.

Salford.—LOAN.—The Corporation Electricity Committee is making application for sanction to loans of £2,711, for the erection and equipment of static transformer sub-stations; £15,000, for sub-stations on consumers' premises, transformer pits and switch pillars; and £120,000, for mains and service cables in Salford and Prestwich.

Special Orders.—Application is to be made to the Electricity Commissioners for Special Orders (*a*) by the Colchester Corporation authorising it to extend its area of supply so as to include the urban district of Walton-on-the-Naze; and (*b*) by the Isle of Thanet Electric Supply Co., Ltd., authorising it to supply electricity in the parishes of St. Lawrence Extra, Minster, Acol, Monkton, Sarre, and St. Nicholas-at-Wade in the rural district of the Isle of Thanet.

Stalybridge.—LOANS SANCTIONED.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has received sanction to the borrowing of £72,523 for mains, £7,580 for the assisted wiring scheme, and £20,000 for hire-purchase apparatus.

Stoke-on-Trent.—EXTENSIONS.—The Corporation Electricity Committee has decided to lay a main from the Hanford Bridge sub-station to the premises of the Trent Vale Brick & Tile Co., Ltd., at an estimated cost of £2,200.

United States.—THE HETCH HETCHY SCHEME.—According to *Power*, the Department of the Interior recently held a conference, at the request of the city of San Francisco, to discuss the city's programme for compliance with the Raker Act, under which the city's water and power development at Hetch Hetchy Valley in the Yosemite National Park was permitted. That Act requires the city to acquire and operate its own power distributing system; but recently proposals which would have authorised the issuance of bonds to purchase privately-owned distributing systems failed.

NEW SPIER FALLS UNIT INAUGURATED.—A new 57,000-h.p. generator was started up recently at the Spier Falls hydro-electric station. The addition will give Spier Falls a capacity of 100,000 h.p., making it the largest hydro-electric station in the state, with the exception of the Schoellkopf station at Niagara Falls. Its completion gives the Niagara-Hudson system a capacity of nearly 2,000,000 h.p.

FLOATING POWER STATION.—A power ship, the *Jacona*, has been put into service at Bucksport, Me., by the New England Public Services to act as a stand-by for the inter-connected electrical systems of northern New England. Such floating plant costs a good deal less than the stationary steam plant that would otherwise be required, and it is believed that about twice as many hours of use will be possible as with a stationary plant. The length of transmission lines to assure stand-by power and constant service to all parts of a regional power system is also reduced by the use of a marine power unit.—*Reuter's Trade Service* (New York).

York.—MAINS EXTENSIONS.—A proposal of the Electricity Committee to extend h.p. and l.p. mains to various outlying villages has been approved by the Unemployment Grants Committee for the purpose of a grant. It is proposed to put the work in hand and to apply for sanction to loans totalling £29,853, the estimated cost of the work.

TRANSFORMER STATIONS.—The Electricity Committee is to erect two transformer stations on the Heworth Green estate.

Tramway and Railway Notes.

Australia.—BRISBANE.—Following a decision of the Industrial Court, the working hours of the Brisbane tramway men are to be increased from 44 to 48 hours a week. There will be no dismissals, the motormen and conductors having agreed to stand down without pay one week out of every eleven. The hourly rates of pay are also to be reduced slightly.

Brazil.—SAO PAULO.—The *Monthly Review* of the Bank of London and S. America states that a Message has been sent to Congress by the president of the Republic asking for permission to sign an agreement with the Sao Paulo Railway Co. for the improvement of the transport conditions. At the present time the entire transport service is in the hands of the railway company, whose railways descend the Serra to the coast by a funicular system run under exceptional difficulties. It is now proposed that an electrically-operated adhesion line should be constructed, the cost of the undertaking to be met by a loan raised by the company.

Continental.—GERMANY.—Dr. Klemens Marx, chairman of the Reich Railway Board, has just announced the results of the operation of the electrified railways in Berlin and the suburbs. The occasion for the conversion to electric traction arose in connection with the necessity for a complete renewal of the rolling stock, the increase in the maximum speed and the shortening of the time occupied in transport. In these respects considerable progress has been achieved. On the city railway the maximum speed has been raised to 55 km an hour, on the Berlin circle railway to 65 km, and on the suburban sections to 80 km an hour. The time of transport has been reduced by about 25 per cent. During the first year of electrical working (May 15th, 1929, to May 14th, 1930), the traffic increased by 12.8 per cent., although in the rush hours the increase was 28 per cent. Through the conversion it has been possible to raise the share of the Reich railway in the total Berlin local and suburban traffic to its pre-war level of over 30 per cent. As a disadvantage of the electrification of the lines, Dr. Marx characterised the abandonment by employers and workmen of the former graduation of the working shift, which had had the effect of crowding the system at definite hours. The result to the Reich railway company was to cause it to incur additional expenses which were estimated at 18,000,000 marks. Financially the Berlin city and suburban traffic has never paid its way, but the working deficit was reduced from 31,000,000 marks in 1927 to 19,000,000 marks in 1929.

Coventry.—NEW TRAMCARS.—The Town Council is to purchase five new tramcars.

Dewsbury.—TRAMWAY ABANDONMENT.—A resolution has been passed by the Town Council providing, subject to satisfactory terms being arranged with the Yorkshire (Woollen District) Electric Tramways, Ltd., for the abolition of the tramway system and the substitution of motor-omnibuses. At present the tramway track is leased from the Corporation by the tramway company, the lease expiring in 1933.

Glasgow.—REGENERATIVE CONTROL FOR TRAMWAYS.—At a recent meeting of the Corporation Transport Committee a report was presented by representatives who attended a special session of the International Union of Tramways, &c., in Paris on the subject of regenerative control for tramways. It was proposed that the Municipal Tramways and Transport Association should take up this matter for the purpose of having the scheme further demonstrated. The Committee, after discussion, agreed to recommend that, in the event of the Association resolving to proceed further in the matter and to arrange for a test being made in Glasgow, the manager be authorised to obtain a complete equipment adapted for regeneration by the Metropolitan-Vickers Electrical Co., Ltd.

THE BOW TROLLEY.—The Transport Committee has received a report by the manager on the working of the bow trolley which had been fitted on a number of the tramcars for trial purposes. It is recommended by the Committee that the bow trolley should now be fitted on all the cars, and that, in order to enable the Transport Department to construct the apparatus in its own works, the patent rights of the "Rischer" bow gear should be purchased.

India.—RAILWAY ELECTRIFICATION IN MADRAS.—According to *Indian Engineering*, the first electrification scheme undertaken in Madras by the South Indian Railway is nearing completion. The work on the track, which covers 18 miles between Tambaram and Egmore stations, is practically finished. Though the formal opening of the line will not be till April, trains are expected to run before. The multiple unit system is to be adopted.

Ipswich.—RAILLESS CARS.—The Corporation is to apply to the Minister of Transport for a Provisional Order authorising it to operate railless-car services on seven routes.

Tynemouth.—TRAMWAY ABANDONMENT.—The Corporation Watch and Town Improvement Joint Sub-Committee has approved in principle a proposal for the abolition of the tramway system and the substitution of omnibuses.

Wallasey.—RAILLESS CARS.—The Corporation has applied to the Minister of Transport for a Provisional Order authorising it to operate railless-car services on fifteen routes.

Wigan.—TRAMWAY ABANDONMENT.—The tramway service on the Corporation's Ashton-in-Makerfield route ceased operation on Sunday last. Motor-omnibuses are being substituted.

York.—RAILLESS CARS.—The City Council has applied to the Minister of Transport for a Provisional Order authorising it to run a railless-car service from the junction of Parliament Street and Pavement, along Piccadilly, Fishergate, Fulford Road and Heslington Lane as far as Back Lane.

Telegraph and Telephone Notes.

Abyssinia.—RADIO STATIONS.—The Government is having wireless stations erected at Addis Abeba. The work of construction is under the supervision of an Italian engineer.—*Reuter* (Addis Abeba).

Australia.—"CARRIER" TELEPHONY.—By Christmas telephone communication will be possible between Adelaide and Perth. A "carrier" circuit is now being added to the existing pair of copper wires on the overland telegraph line; when that section has been completed all the Australian State capitals will be linked by telephone, and it will be possible to talk between Geraldton (West Australia) and Townsville (Queensland), approximately 4,600 miles, making one of the longest lines in the world.—*Reuter* (Sydney).

WIRELESS TELEPHONY SERVICE TO JAVA.—Wireless-telephone communication between Australia and Java is expected to be established before the end of the year. Preliminary conversations have been held to discuss charges and technical details.

Channel Islands.—TELEPHONY.—The work of establishing telephone communication between England and Jersey and Guernsey is being pressed forward, and it is hoped that the service will be available to the public early next year, states the Postmaster-General in a written answer to a Parliamentary question.

China.—NEW RADIO SERVICE.—The Ministry of Communications was to inaugurate last week direct commercial wireless communication between China and America. The up-to-date sending and receiving equipment, which has been two years under construction, is situated just outside Shanghai, but the control of the station is in the heart of the business section of the international settlement. The station will work in co-operation with the Radio Corporation of America, which has established a similarly powerful station in San Francisco. Commercial business was to commence on December 1st.—*Reuter* (Shanghai).

The investigation conducted by deputies of the Ministry of Communications in Shanghai regarding telephone installations and the total number of telephones beyond Settlement limits put up by the Shanghai Mutual Telephone Co. has been completed. In a communication to the Ministry of Foreign Affairs, the Ministry of Communications requests that the consular body in Shanghai be immediately notified to instruct the foreign telephone company to remove its telephone lines from territory outside of Settlement limits.

Irish Free State.—RADIO BEACON.—The construction of a wireless direction-finding station at Mizzen Head, County Cork coast, is approaching completion. An unusually tall mast, which is over 300 ft. above sea level, has just been erected there. It is the most westerly station of its kind, and will be of the greatest importance for ships in the Atlantic Ocean.

Radio-telephony.—ENGLAND-NEW ZEALAND SERVICE.—Preliminary tests having proved satisfactory, a radio-telephone service between New Zealand and Great Britain is about to begin.—*Reuter* (Wellington).

A similar service between New Zealand and Australia was inaugurated on November 25th.

Russia.—TELEPHONY.—The Peoples Commission of the Soviet Russian Posts and Telegraphs has drawn up a five-years plan for the extension and popularisation of telephony. At present about 19,000 telephones only are in use in Soviet Russia, but it is hoped to increase that number to 303,000 during the above-mentioned period.

Ship-shore Telephony.—LONDON.—The Port of London lags behind several of its British and foreign rivals in the facilities provided for ship-to-shore telephone communication, in the opinion of Mr. H. Willoughby Lovell, the Admiralty Marshal, who suggests that telephone cables should be laid to the principal buoys in the River Thames for the convenience of vessels lying in the river. Direct ship-to-shore connections have lately been established at Cardiff, Swansea, and Newport, and on the Tyne a number of berths have installations which make it possible, on the arrival of a ship, to place a portable telephone on board. He suggests that savings of time and money would be effected if cables were laid to buoys in the Thames. Not only would telephony expedite the completion of the ship's business by putting the master in instant communication with the agents, brokers, and the Port authorities ashore, but it would also prove invaluable in enabling assistance to be obtained in cases of accidents. Payment for calls need not, added Mr. Lovell, present any real difficulty, as it could be ensured by the Customs not granting clearance until all charges had been paid, the telephone charges forming part of the ordinary port dues. Inquiries among ship owners revealed that there was a general feeling in favour of the Admiralty Marshal's proposal. One ship owner pointed out that the experiment had already proved successful in Hamburg.

Radio Notes.

Battery Eliminators.—BIRKENHEAD.—The Corporation Electricity Committee has received from its electrical engineer certain proposals as to the conditions upon which compensation should be made to owners of radio apparatus which would be rendered inoperative by the proposed change-over of the electricity distribution system. The Committee agreed to the proposals provided they were approved, from a legal point of view, by the town clerk after scrutiny.

Belgium.—ANTI-INTERFERENCE LEGISLATION.—By a by-law passed by the town of Ciney, in the province of Namur, in October to compel all possessors of electrical machinery to equip it with the necessary apparatus required to prevent interference with wireless transmission, offenders render themselves liable to a fine of from five to fifteen francs for each offence, or to imprisonment up to seven days.

Canada.—NEW STATION.—A station is apparently to be built at North Bay in the near future, for application has been made to the Dominion Government for a broadcasting licence, and the project is being strongly supported by the local board of trade and city council. The new station, to be owned and operated by the Northern Supplies, Ltd., would have its studio in the Capitol Theatre building, says *World-Radio*, and the equipment to be used is that of a 50-watt station, originally CKNC, Toronto.

ANTI-INTERFERENCE BY-LAW.—The Council of Brockville has adopted a by-law making it compulsory for all electric signs now, or subsequently, erected in the town to be equipped with condensers, or other devices, to prevent interference with radio receiving sets.

Hungary.—LICENCES.—At the end of 1928 the number of listeners was just under 100,000, and now it is just under 300,000, in addition to the 9,000 listeners of the wired broadcasting system of the Telefon Hirmondo. Owing to reception difficulties in some parts, says *World-Radio*, and to the fact that foreign stations are in some cases easier to receive than the home station, two new relays, of 10-kW aerial power each, will be opened towards the end of 1931; one in western Hungary, the other in north-eastern Hungary. Towards the end of 1932 a 100-kW transmitter will be ordered for Budapest.

New Valves.—COSSOR AND MULLARD TYPES.—Most users of valve receivers must have been annoyed some time or other by "microphonic howl." A. C. Cossor, Ltd., claims that the trouble can now be overcome as the result of the evolution of a method of gripping the valve filament in seven places by means of a spiral spring and very small porcelain-covered hooks, which unusual method of construction has been embodied in a special 210 detector valve that is now available.

The Mullard Wireless Service Co., Ltd., announces the addition of type S.4VB to its range of screen-grid a.c. valves, which now number three with impedances of 909,000, 430,000, and 257,000 ohms, respectively, suitable for selection according to circuit conditions.

Russia.—NEW STATIONS.—The Peoples Commission of the Soviet Posts and Telegraphs has drawn up a five-years plan for the construction of 62 more broadcasting stations, as the result of which it is hoped to increase the number of receiving instruments in use to no less than 14 millions.

Scotland.—NEW REGIONAL HEADQUARTERS.—The British Broadcasting Corporation's new regional headquarters were officially opened on November 29th, the ceremony being broadcast by all the Scottish stations. "Broadcasting House" is in Queen Street, Edinburgh, and the building contains the largest studio in Britain, which is remarkable for its admirable theatre, in which a large audience will be able to watch as well as to listen from the galleries and floor. The lighting is in the most modern style, and the coloured fabric which lines the walls has been woven by the "Edinburgh Weavers," who have also been responsible for the beautiful tapestry in the small talks studio, which will be decorated in the manner of a study. The third studio, of intermediate size, will be used for the broadcasting of chamber music and songs. The building is familiar to Edinburgh citizens as the old "Queen's Hall."

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. January 6th. Indicators. (A.X. 10403.)* Submarine cable. (A.X. 10309.)*

January 13th. Terminal strips. (A.X. 10465.)* Four sets of echo suppressors for two-wire repeatered circuits. (A.X. 10523.)*

January 20th. Telephone switchboard keys and parts, including handles, make springs, break springs, and key plates. (A.X. 10517.)*

January 27th. Fuses and heat coils for the protection of telephone equipment. (A.X. 10516.)*

February 3rd. Telephone exchange power boards. (A.X. 10466.)*

February 10th. Telephonists' telephones for common battery working. (A.X. 10569.)*

January 12th. State Electricity Commission. 44,000-V switchgear and accessories for the Belmont and Colac sub-stations. (A.X. 10543.)*

Victorian Railway Commissioners.—January 7th. Remote control circuit breakers and accessories. (A.X. 10493.)*

Barking.—December 8th. Urban District Council. Two 250-kVA transformers. (November 28th.)

Denmark.—COPENHAGEN.—January 3rd. Municipal Lighting Department. 40,000 kVA transformers. (A.X. 10568.)*

Eccles.—December 8th. Works Department. Installation of electric lighting and power, wiring, fittings, &c., in the worshops and offices in Clifford Street, Peel Green. (November 28th.)

Edinburgh.—December 9th. Corporation Electricity Department. Installation of electric lighting and electric heating in police garage and offices, &c., at Cowgate and in the police garage and muster room at Charlotte Street, Leith. Specifications, &c., from Engineer's Office, Dewar Place (deposit £1 1s.); tenders to Town Clerk.

Glasgow.—December 19th. Corporation Health Department. Electric lighting and bells at new house for medical superintendent at Ruchill Hospital. Specifications from Office of Public Works, City Chambers (deposit £2 2s.); offers to Town Clerk.

London. — LONDON COUNTY COUNCIL.—December 18th. Wiring and fittings for electric lighting in tenements at Ossulston estate, St. Pancras. (November 14th.)

December 22nd. Wiring and fittings for electric lighting in 39 blocks of tenement dwellings at the Leigham Court Road housing site, Streatham Hill. (November 28th.)

Manchester.—December 30th. Electricity Committee. A sheet steel kiosk and 6,600-V switchgear. (See this issue.)

Middlesbrough.—December 8th. Corporation. Six sets of traffic signals. (November 28th.)

Newcastle.—NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.—January 14th. Piping equipment for power station. (November 28th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 19th. Electric lamps and condensers. (A.X. 10446.)*

January 20th. Resistance spools. (A.X. 10505.)*

January 24th. 300 four-conductor dial cords. (A.X. 10556.)*

January 26th. 500 ebonite telephone earpieces. (A.X. 10555.)*

PUBLIC WORKS DEPARTMENT.—January 27th. 11,000-V switchgear and metering for Mangahao power scheme (A.X. 10373.)*

February 24th. One set of 110-kVA outdoor switchgear, steel-work and controlling equipment. (A.X. 10507.)*

Northern Ireland.—MINISTRY OF COMMERCE.—January 1st. 33-kV wood-pole overhead transmission lines. (November 28th.)

West Midlands.—JOINT ELECTRICITY AUTHORITY.—December 10th. Single-circuit 33,000-V overhead transmission line supported by steel towers. (November 21st.)

December 13th. Underground cables and services in Newport (Salop) urban district. (November 28th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barking.—Electricity Committee. Recommended:—
Extension to low-pressure switchboard at Gale Street sub-station (£103).—New Switchgear Construction Co., Ltd.

Bedford.—Town Council. Accepted:—
Skeleton wiring installation at the electricity showrooms.—H. Bacchus, Ltd.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£378).—Hackbridge Cable Co., Ltd.

Birmingham.—Education Committee. Accepted:—
Installation of electric lighting at the new Bushmore Farm school, Hall Green (£1,537).—Thomas Glover.

Essex.—Public Assistance Committee. Accepted:—
Installation of electric lighting in the infirmary block at the Maldon Institution (£344).—A. Shearman.

Glasgow.—Education Committee. Recommended:—
Electric oven for Kinning Park cooking depôt (£525).—General Electric Co., Ltd.
Transport Committee. Recommended:—
Crane for Larkfield garage.—Vaughan Crane Co., Ltd.
Fishplates.—Dorman Long & Co., Ltd.

Grimsby.—Electricity Committee. Recommended:—
Switchgear (£5,580).—Metropolitan-Vickers Electrical Co., Ltd.
Cable drum carriage (£179).—J. & J. Bescoby.

Hull.—Water and Gas Committee. Accepted:—
Electric lighting at Dunswell engine house (£148).—Napier & Wheeldon (in lieu of withdrawn tender).
Health Committee. Accepted:—
Electric lighting at new pavilion at City Hospital (£140).—J. C. Coulchan.

Leyton.—Town Council. Accepted:—
Car traverser (£415).—Holt & Willetts.
Tramcar bodies (£89,375).—English Electric Co., Ltd.
Swing bolster tramcar trucks (£13,225).—Electro-Mechanical Brake Co., Ltd.
Magnetic track and wheel brake equipments (£2,537).—Metropolitan-Vickers Electrical Co., Ltd.
Electrical equipments (£40,675).—British Thomson-Houston Co., Ltd.

London.—POPLAR.—L.C.C. Recommended:—
Electrical installation in extensions of the School of Engineering (£1,280).—H. J. Cash & Co., Ltd.

Manchester.—Gas Committee. Accepted:—
Wiring for electric lighting and equipment for the waterless gas holder.—Bertram Thomas.
Transport Committee. Accepted:—
Cadmium-copper trolley wire.—Whitecross Co., Ltd.
Electricity Committee. Accepted:—
Installation of high-pressure steam and drain pipework, &c., at Barton power station.—John Spencer, Ltd.
Battery-charging equipment, Polygon Garage.—Metropolitan-Vickers Electrical Co., Ltd.
Electric vehicle batteries.—Tudor Accumulator Co., Ltd.; Britannia Batteries, Ltd.
6,600-V, 3-phase, overhead line (northen Etchells).—Callender's Cable and Construction Co., Ltd.

Middlesex.—Public Assistance Committee. Accepted:—
Cable at North Middlesex Hospital (£429).—Buchanan and Curwen.

Morecambe.—Electricity Committee. Accepted:—
Erection of sub-station at Broadway.—Johnson & Phillips, Ltd.
Coastal Road Committee. Accepted.
Lamp standards for Coastal Road.—Revo Electric Co., Ltd.

Sheffield.—Electric Supply Committee. Accepted:—
Sub-station switchgear (£1,277).—A. Reyrolle & Co., Ltd.

Forthcoming Events.

Institution of Electrical Engineers (Meter and Instrument Section).—Friday, December 5th. Institution, London. 7 p.m. "The Metering of Three-phase Supplies." Mr. O. Howarth.

(London Students' Section).—Monday, December 8th. Institution, London. 7 p.m. Informal meeting. Discussion on "Impulse *versus* Synchronous Time Service." Opened by Mr. A. O. Gibbon and Lieut.-Col. K. Edgcumbe. Friday, December 12th. Institution, London. 6.15 p.m. "Laboratory Method as met with in Wireless Technique." Mr. W. D. Oliphant. Saturday, December 13th. 2.30 p.m. Visit to the West Ham power station.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 8th. The University, Liverpool. 7 p.m. "The Metering of Three-phase Supplies." Mr. O. Howarth. "The Electrical High-Pressure Testing of Cables and the Localisation of Faults." Mr. J. Urmston.

(North-Eastern Centre).—Monday, December 8th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "Loud-speakers since their Conception with Gramophone Pick-ups and Wireless Recording Apparatus." Mr. S. G. Brown.

(South Midland Centre).—Monday, December 8th. The University, Birmingham. 7 p.m. "The Cooling of Electrical Machines." Mr. D. B. Hoseason.

(North Midland Centre).—Tuesday, December 9th. Hotel Metropole, Leeds. 7 p.m. "Loud-speakers since their Conception with Gramophone Pick-ups and Wireless Recording Apparatus," by Mr. S. G. Brown. To be delivered by Major C. A. Russell Stower.

(North-Western Centre).—Tuesday, December 9th. Engineers' Club, Manchester. 7 p.m. "The Theory and Performance of Phase Advancers." Dr. J. J. Rudra and Prof. Miles Walker.

(Scottish Centre).—Tuesday, December 9th. Institution of Engineers and Shipbuilders in Scotland, Glasgow. 7.30 p.m. "The Cooling of Electrical Machines." Mr. D. B. Hoseason.

(Hampshire Sub-Centre).—Wednesday, December 10th. University College, Southampton. 7.30 p.m. "Voltage Control of Large Alternators." Mr. H. W. Taylor.

(Dundee Sub-Centre).—Thursday, December 11th. University College, Dundee. 7.30 p.m. "Electricity and Mining—A Story of Progress." Mr. A. V. Reis.

(North-Eastern Students' Section).—Friday, December 12th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Address by Dr. W. M. Thornton.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 6th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Nickel-Cadmium Alkaline Cell." Mr. F. Watson-Mann.

Electrical Power Engineers' Association (Tees-side Section).—Saturday, December 6th. Metropole Hotel, Stockton-on-Tees. 6 for 6.30 p.m. First annual dinner.

Institution of Civil Engineers.—Wednesday, December 10th. Institution, London. 6 p.m. Informal meeting. "Atmospheric Pollution due to Combustion of Fuel, and Methods for its Prevention." Mr. J. S. Owens.

Television Society.—Wednesday, December 10th. University College, Gower Street, W.C. 7 p.m. "Television in Natural Colours and the Fundamental Problems Involved." Mr. T. Thorne Baker.

Institution of Engineering Inspection.—Wednesday, December 10th. Royal Society of Arts, London. 5.30 p.m. "Power Station Efficiency." Mr. P. Rycroft.

Institute of Fuel.—Wednesday, December 10th. Chemical Society, Burlington House, Piccadilly, W. 6 p.m. Joint meeting with the Diesel Engine Users' Association, Institution of Petroleum Technologists, and the Coke Oven Managers' Association. "High-powered Gas and Diesel Engines for Electrical Generation." Mr. M. Gercke.

Batti-Wallahs' Society.—Thursday, December 11th. Hotel Metropole, London. 12.30 for 1 p.m. Luncheon. Chief guest Sir Philip Dawson. Subject: "Railway Electrification in England."

Illuminating Engineering Society.—Friday, December 12th. 4 p.m. Visit to the Chiswick works of the London General Omnibus Co., Ltd. 6.30 p.m. Holophane, Ltd., Elverton Street, Vincent Square, S.W. "Glasses for Use with Invisible (Ultra-violet and Infra-red) Rays." Dr. S. English.

Electricity in Mines.

Mr. J. A. B. Horsley, H.M. Chief Electrical Inspector of Mines, speaking at the Chesterfield Technical College prize distribution recently, said that in ten years the use of electric motors in mines had increased from one million to 1¾ million horse-power, the annual increase being about 70,000 h.p. Electricity in mines was not the deadly thing that some people would have them believe. Deaths were less than one per cent. of the deaths due to all other accidents.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

ELLAMS transformers.

An electrical machine for mending ladders in silk stockings.

CLIMAX vacuum cleaners.

RUSTON cable sockets.

Notes.

Rationalisation in the Iron and Steel Industry.

The decision come to at a recent meeting of the Council of the British Engineering Standards Association to appoint an Iron and Steel Industry Committee is one which will have a far-reaching effect in the iron and steel industry. It was arrived at as a result of a resolution passed by a fully representative conference held at the Institution of Civil Engineers on October 17th. The conference was presided over by Sir William Larke, K.B.E., director of the National Federation of Iron and Steel Manufacturers, and included representatives of upwards of 60 organisations and Government Departments, thus being fully representative of users and producers, and of the research and technical institutions. The desirability of reducing the number and requirements of specifications to the simplest form consistent with modern needs, and the necessity for co-operation between users and producers to secure that result, were recognised by all speakers. The reduction of unnecessary differences between specifications and requirements for similar services could only be secured by such co-operation as would be rendered possible by the appointment of an Iron and Steel Industry Committee through the operations of which it was confidently anticipated that productive efficiency would ultimately be increased. By the reduction of cost for a given service which must inevitably result, a stimulus would be given to the development of capital enterprise, which could not fail have a substantial effect, as an important contributing factor in restoring prosperity, not only to the industries concerned, but to those dependent upon them also.

Barking Power Station.

An interesting feature of the Barking power station of the County of London Electric Supply Co., Ltd., a full description of which appeared in our issues of November 21st and 28th, is the "Lux" fire-extinguishing installation. This consists of 140 cylinders, each charged with 50 lb. of carbon-dioxide, manifolded together so that it is possible by opening the necessary valve to flood any one of the transformer chambers and switchrooms. The system allows of the discharge of carbon-dioxide as a liquid, through pipe lines, which does not become gas until it emerges from the special nozzle in the space protected. The cylinders are controlled from a remote position, and do not necessitate going near the fire. As a first-aid outfit for dealing with fires in their initial stages, a "Lux" hand-operated hose-reel unit is installed in each switchroom. The carbon-dioxide for the hose reels is obtained from a battery of four 50-lb. cylinders which is entirely independent of the main supply system. The equipment was supplied and installed by Messrs. Walter Kidde & Co., Inc.

The E.T.B.I.

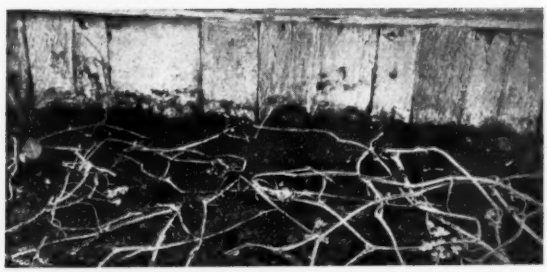
The 12th annual ball in aid of the funds of the Electrical Trades Benevolent Institution was held at Newcastle on November 28th. About 350 people were present, Mr. H. W. Clothier, chairman of the section, and Mrs. Clothier receiving the guests.

The "pigeon contest" organised by Mr. R. E. Robson, after paying expenses, raised between £46 and £47. The word to be guessed was "chat," which is intimately connected with the president's name. No one succeeded in guessing the word, although Chattock was a word sent in, but the nearest approach was the word "keep"; if this subscriber had selected the president instead of the secretary he would have won.

As no one hit on the word, Mr. Clothier decided that a card should be drawn from a bag, which was done by the Lord Mayor of Newcastle, Alderman David Adams, and Mrs. R. A. Kirtley, of East Boldon, Co. Durham, was the winner.

Soil-heating Experiments.

In our issue of June 27th last, p. 1204, we published reproduced photographs of cucumber plants in electrically-heated and ordinary hotbeds 45 days after the seeds were sown. The accompanying illustrations show the same plants as they were on October 22nd, 190 days after the seeds were sown on April 15th. The plant in the electrically-heated soil is shown still growing and bearing fruit, while that in the ordinary hotbed is shown completely dried down to the stalks. Roughly the plant in the electrically-heated hotbed produced between 150 and 200 cucumbers, while that in the ordinary hotbed produced



Cucumber Plants in Electrically-heated (above) and Ordinary Hotbeds 190 Days after Seeds were sown.

about 50. It will be recalled that the demonstration was staged by the South Wales Electrical Power Distribution Co. in order to demonstrate to market gardeners and farmers that besides its labour-saving benefits in the farmhouse, the farm and fields, electricity could help in the hothouse and the forcing frames.

The Association of Consulting Engineers.

The 21st anniversary dinner of the Association of Consulting Engineers (Inc.) was held on November 26th at St. Stephen's Club, London, S.W. Mr. Alfred H. Dykes, chairman of the Committee of the Association, presided over a gathering of about 170, which, as is customary on these occasions, included many eminent members of other professions.

After the honouring of the loyal toast, "The Houses of Parliament" was proposed by MR. E. A. SANDFORD FAWCETT, C.B., and responded to by the RT. HON. LORD HANWORTH (Master of the Rolls), and MR. E. T. CAMPBELL, M.P. All three speeches were light in touch and delightful to listen to, without yielding a great deal for record. Lord Hanworth aptly stressed the value of an independent outlook based on great traditions, which he regarded as a factor common both to the House of Lords and a professional association such as that of his hosts.

SIR JOHN BROOKE (vice-chairman, Electricity Commission), proposing the toast of "The Engineering Industry," referred to engineering as one of the three governing forces of the country. He also remarked upon the fallacies underlying the public's idea of engineering uglification, upon which comment is made in our leading columns.

MR. D. A. BREMNER, O.B.E. (director, British Engineers' Association), responding, emphasised the necessity for the Empire to have a healthy self-contained iron and steel industry. He pointed out that industry was responsible for modern civilisation, but contained possibilities for the destruction of that civilisation. Engineers were trained realists, and they must take part in guiding public affairs if disaster were to be avoided.

The HON. MR. JUSTICE MCCARDIE then proposed "The Association of Consulting Engineers." He referred to the influence of associations of all kinds upon the social structure of the country, and said that an association that existed for the maintenance and elevation of standards of honour, ability, and courtesy, must be of great benefit to the community. MR. A. H. DYKES (chairman), in reply, claimed that consulting engineers had an important future, and referred to the good work carried out by the officials, past and present, of the Association; we comment upon this speech also in our leading columns.

Institution of Electrical Engineers.

LIVERPOOL DINNER.—The annual dinner of the Mersey and North Wales (Liverpool) Centre was held on November 26th at the Adelphi Hotel, Liverpool, under the chairmanship of MR. A. J. PRATT. MR. O. G. MORRIS, in proposing the toast of "The Electrical and Allied Industries," commented on the general activity in the electrical industry, and on how dependent most industries were becoming on a cheap and efficient supply of electricity. SIR WILLIAM NOBLE, in reply, said that he was of the opinion that the electrical industry was the most flourishing in this country, and gave facts and figures in support of his contention. Of the electrical production of the world, the U.S.A. produced 41 per cent., Canada was second, Germany third, and England fourth. The Lord Mayor of Liverpool (ALDERMAN EDWIN THOMPSON), proposing the toast "The Institution of Electrical Engineers," wondered whether it would not be better for the industry if they used a slogan, such as had been found to be so effective in the fruit trade. The masses did not fully know how they could use electricity, and were generally of the opinion that it was an expensive luxury. He also pleaded for the standardisation of parts, especially with regard to plugs and sockets, and for more attention to be given in choosing positions for plugs. MR. C. C. PATERSON, president, said, in reply, that, although they were experiencing better times than many industries, they must not set their standard by the past, but dwell on the future of the industry. PROFESSOR F. J. TEAGO proposed "The Visitors," and COL. SIR T. F. PURVES and MR. E. H. SHAUGHNESSY replied. The toast of "The Chairman" was proposed by DR. E. W. MARCHANT.

BIRMINGHAM DINNER.—The annual dinner of the S.W. Midland Centre was held on November 28th at the Grand Hotel, Birmingham, when MR. G. ROGERS (chairman of the Centre) presided over a gathering of some 360 members and guests. After the honouring of the loyal toast, MR. GEORGE BALFOUR, M.P., proposed "The Institution of Electrical Engineers." He expressed his conviction that, had it not been for the feeling of uncertainty created by legislation in 1919 and 1922, the electrical industry would have taken advantage to a very much greater extent of the trade boom after the war. Further unsettlement had then been caused by the legislation of 1926, but the C.E.B. was fortunately independent of Government control. In 1928-29 the electricity supply industry paid £184,000 in local rates and £255,000 for coal; but while the expenditure on coal was rapidly being reduced, rates were rapidly going up. He asked whether, in the light of that, it was worth while to strive to reduce the fuel consumption by fractional amounts.

MR. C. C. PATERSON, O.B.E. (president, I.E.E.), responding, said that it was particularly necessary just now that electrical engineers should take a broad view of their relations to industry for two reasons. (1) Other and older industries were suffering, and it was the duty of those controlling a monopoly to remember that duty to shareholders was not incompatible with the interests of a wider community. A scientific basis for industry made for adaptability and attracted men of the highest intellectual calibre. There was a likelihood of industries that lived by their wits going down before industries that lived by their brains. (2) The Faraday Centenary was to be celebrated next year. The uses of electricity were increasing very rapidly, but the present position was built upon the researches of previous workers in other branches. They should, however, beware of taking the past as their standard; the only standard was their vision of the future, which must rest upon scientific study and inquiry. The "Faraday touch" should be the inspiration to the electrical engineer that the "Nelson touch" had been to the Navy.

MR. G. ROGERS (chairman), in proposing the health of the "Kindred Societies and Guests," stated his belief that an extension of the duties of the C.E.B. would be essential to electrical development. Much had been done lately to raise the status of the electrical engineer, but more had still to be done.

MR. ALEXANDER RAMSAY (chairman, Managing Board of Engineers and Allied Employers' Federation) replied. He said that the electrical industry had disproved two economic shibboleths: (1) its protected position had not caused it to become inefficient, and (2) its members had not (he was informed) combined to plunder the community. We were at the beginning of the electrical epoch which, he believed, would make a new industrial revolution. We were at present, however, the victims of an amazing paradox—the world was poor because it had produced too much wealth; this was due to the bondage to gold, which had failed as a medium of fair exchange. The great majority of people in the world were still in a state of primitive civilisation, and if they could make one step forward in general culture, the manufacturing nations would have as much work as they could handle. To bring this about they need only give to the science of living a fraction of the energy they gave to material invention.

MR. N. B. ROSHER (vice-chairman) proposed the health of the chairman, who briefly responded.

After the conclusion of the speeches the remainder of the evening was devoted to a re-union.

INFORMAL MEETING.—At the informal meeting held on November 24th, Mr. W. A. Ritchie was in the chair, and Mr. J. Paley Yorke, M.Sc., opened a discussion on "The Syllabuses of Day and Evening Courses in Electrical Engineer-

ing: do they meet Commercial Requirements?" Courses and their general purposes at the various technical colleges were reviewed, and it was claimed that generally they complied with the demands, if not with the needs, of the student. When there were shortcomings the fault lay with the industry and not with the colleges. It was agreed that too often there was a tendency to treat mathematics as a mode of thought rather than as a tool, and there was also some bias towards the teaching of design rather than practical application. In respect of engineering economics, colleges were eager to supply what students needed, but no authority had indicated what was required. To a suggestion that by rationalisation of the advanced courses highly specialised subjects could be taught, it was pointed out that that was an accomplished fact as a few colleges were now permitted to enlist specialists in advanced subjects, such lectures being open to students of all colleges.

Mr. W. M. Parkinson said the educationalist was faced with the dilemma of either having to frame a syllabus that would attract a few good students, or one that would look attractive to parents in London. He had found it better to run mathematical courses as part of the general technical course, so that they were practically calculation courses. He thought the bias towards design was giving way to an inclination towards the power supply side.

Mr. P. Kemp said industry was not very articulate and the schools could only provide the student with a general standard of training, as it was impossible to foretell what his future activities might be. He did not think employers in the south were as sympathetic towards providing educational facilities for their staffs as were those of the north.

Messrs. J. Coxon, P. Dunsheath, O.B.E., W. A. Erlebach, W. J. Minton, A. Morgan, E. J. Reed, W. A. Ritchie, Dr. A. Rosen, F. Rowland, F. P. Sexton and J. F. Shipley, also spoke.

Legal.

THEFT OF ELECTRICITY.—Horace Buckley, electrical engineer, was fined £5 at Coleshill last week for diverting electricity, the property of the Birmingham Corporation, to his house on November 14th and previous dates. A representative of the Birmingham Corporation stated that the supply of electricity to defendant's house was disconnected and the fuses were removed. Later, the district engineer took further precautions by cutting the cable leading to the house. On November 11th the electrical engineer noticed that two unauthorised tappings had been made from the main overhead supply cable which passed near the house. From these, tapping wires led into the house, where they were connected with a lamp socket and an electric cooker. These connections had been in existence for five weeks, during which time nothing was registered by the meter.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The *British Chamber of Commerce Journal*, Shanghai, reports the arrival in that city of **Mr. D. K. Pakington** and **Mr. E. Williams**, of the International Standard Electric Co., to join the engineering staff of the Shanghai Telephone Co.

The accompanying picture is reproduced from a flash-light photograph taken at the works of Messrs. Ferranti, Ltd., Hollinwood, last week. In the centre of the group is **Mr. V. Z. de Ferranti**, with **Mr. C. W. Marshall**, of the Central Electricity Board, on his left, and **Mr. Whitcher**, of Messrs. Kennedy & Donkin, the second figure on his right. The transformer in the foreground is one of 80,000-kVA capacity for the new station at Battersea, whilst the one behind it is a 60,000-kVA unit for Deptford.

A Group at Ferranti's Works.

Mr. J. McKeown, chief superintendent of the Telegraph Department, Belfast, has retired on superannuation after 44 years' service.

Mr. G. Gregory informs us that he has relinquished his appointment as manager of the combined Battery Service Department of the Lucas, C.A.V., and Rotax Companies, his resignation having effect as and from November 30th. His address is 30, Cumberland Park, Acton, W.3.

The **Marchese Marconi** was formally installed as President of the Royal Italian Academy by Signor Mussolini on November 29th.

Mr. James Scott, consulting electrical engineer of Liverpool and Bootle, was re-elected a member of the Bootle Town Council in a by-election last week.

Mr. E. S. Rayner, general manager, **Mr. B. J. Bruce**, rolling stock superintendent, and **Mr. Ingram**, of the Hull Corporation Tramway Department, were called upon by the City Council on October 21st to resign their appointments. Acting upon legal advice, they declined to tender their resignations, and the *Yorkshire Post* reports that the Tramways Committee has decided to defer consideration of the matter for a year. A proposal that the three officials should be given six months' notice terminating their engagements was defeated.

The Bexley Urban Council, on the recommendation of the Electricity and Tramways Committee, has granted the following increases of salary: **Mr. A. J. Abraham**, engineer and manager, from £700 to £800, with two annual increments of £25 to £850; **Mr. F. A. Buley**, assistant electrical engineer, from £325 to £350, subject to his taking over overhead work; **Mr. W. E. Wicks**, mains superintendent, from £325 to £350, subject to his being taken off overhead work; and **Mr. F. B. Pearce**, assistant mains superintendent, from £250 by five annual increments of £10 to a maximum of £300.

Under the Budget scheme of the Government of Victoria for a percentage reduction of salaries, it is proposed to reduce that of **Sir John Monash**, chairman of the Electricity Commission, from £3,000 to £2,400 per annum. As Sir John was appointed by contract, in the absence of a voluntary agreement, his salary can be reduced only by Act of Parliament, and in order to avoid this he is being asked to consent to the reduction.

It has been decided by the committee in charge of the presentation to **Mr. Laurence J. Kettle**, Dublin city electrical engineer, in deference to the wishes of Mr. Kettle, that the presentation shall take the form of a prize or premium, which will be awarded every year by the Institution of Civil Engineers of Ireland, and an album containing the subscribers' names with an appreciation of Mr. Kettle's services as Dublin electrical engineer in the work of the development of electricity in the Irish Free State.

On Wednesday last week the **Rt. Hon. G. W. Forbes**, Prime Minister of New Zealand, and other New Zealand delegates to the recent Imperial Conference, paid a visit to the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd. The party was received by Sir Philip Nash, chairman, and Mr.

G. E. Bailey, director, and other principal officials of the company, and was conducted through the new West Switchgear Assembly Works where the visitors were shown one of the colossal metal-clad switches for Battersea. They then went through the winding and insulation departments, the main electrical and mechanical aisles, and the automatic sub-station. They later witnessed a special demonstration in the high-voltage laboratory. The photograph which we reproduce herewith was taken with a background of switch tanks which have been ordered for the north-western section of the grid.

Lt.-Col. T. S. Morrisey, D.S.O., vice-president and general manager, Combustion Engineering Corporation, Ltd., Canada, an associate of International Combustion, Ltd., has arrived in this country and is staying at Flemings Hotel, Clarges Street, W.1. Col. Morrisey is severing his connection with Combustion Engineering Corporation, Ltd., at the end of this year in order to join the board of United Engineers and Constructors (Canada), Ltd., of which Mr. Dwight P. Robinson is the principal, and during his visit to this country desires to meet executives of any British industries contemplating the establishment of factories in canadian territory.

Mr. William Chamberlain is resigning his appointment as general manager of the Belfast City tramways to take up the position of chairman of the Regional Traffic Commission for North-West England, which has been established under the 1930 Road Traffic Act.

Obituary.

Mr. A. Mackenzie.—We regret to report the death, in Edinburgh, of Mr. Alexander Mackenzie, chairman of Messrs. Mackenzie and Moncur, Ltd. He became a director of the company about 36 years ago and took a very active part in its development. He was also a director of Bruce Peebles & Co., Ltd. He was in his 67th year and is survived by his wife and three sons, the latter being connected with the company.

Mr. H. Goddard.—The death took place on November 19th of Mr. Henry Goddard, who had for 24 years been engaged in the Electricity Department of the Warrington Corporation. Five years ago he was appointed engineer-in-charge at Lymm.

Mr. D. H. Bonnella.—We regret to hear that Mr. D. H. Bonnella, founder and chairman of Messrs. D. H. Bonnella and Son, Ltd., passed away on November 28th. Mr. Bonnella He was 49 years of age, and served his apprenticeship at the Helsby Cable Works.

Front row, left to right: The Town Clerk, Mr. F. E. W. Howell; Mr. G. E. Bailey; the Rt. Hon. G. W. Forbes; Sir Philip Nash; the Lord Mayor of Manchester; Sir Herbert Daw; Alderman Davy; and Mr K. Baumann.
Back row: The Chief Constable; Mr. K. G. Maxwell; Mr. E. J. Summerhill; Mr. G. A. Juhlin; Lt.-Col. E. Murray; Mr. C. A. Jeffery; Mr. C. A. Berendson; Mr. J. C. Whitmoyer; Mr. T. H. B. Drew; and Mr. H. C. Pierson.

The New Zealand Premier at the Metro.-Vick. Works.

celebrated his 90th birthday in April last, and until two or three years prior to that was actively engaged in the business. The funeral took place on Wednesday last at the Westminster Cemetery, Hanwell.

Mr. C. L. Reed.—The death occurred last week, in tragic circumstances, of Mr. Cecil Langham Reed, a director of the Venezuela Telephone & Electrical Appliances Co., Ltd., and other companies.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Wad Medani Light & Power Co., Ltd.—Registered as a public company November 28th. Capital, £100,000 in £1 shares (50,000 6 per cent. cumulative participating preference and 50,000 deferred). Objects:—To construct, work, develop and control public works and conveniences of all kinds in Sudan and elsewhere; to generate, accumulate, distribute and supply electricity, and to carry on the business of electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus, suppliers of water, &c. The first directors are:—Lord Meston, "Hurst," Cookham Dene, Berks (director of Sudan Light and Power Co., Ltd.); P. J. Pybus, C.B.E., M.P., Queen's House, Kingsway, W.C. (director of Sudan Light and Power Co., Ltd.); E. H. Lever, 142, Holborn Bars, E.C. (director of Power and Traction Finance Co. (Poland), Ltd.); W. G. Hendry, "Twyford," Caterham Valley; Sir Edward Colpoys Midwinter, K.B.E., Wellington House, Buckingham Gate, S.W. (controller of Sudan Government London Office); C. G. Hodgson, Wellington House, Buckingham Gate, S.W. (advisory engineer, Sudan Government); H. P. Hewins, Quarry House, Liphook, Hants. No person shall be appointed a director without the consent of the Sudan Government. The chairman is to be nominated by the Prudential Assurance Co., Ltd., the English Electric Co., Ltd., and Callender's Cable and Construction Co., Ltd., but his appointment shall be subject to the approval of the Sudan Government. Of the other directors, the Government shall have the right to nominate half, and the group of companies the other half. Secretary: T. Lawrie. Registered office: Queen's House, Kingsway, W.C.2.

Giffens, Ltd.—Private company. Registered November 28th. Capital, £5,000 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, battery and wireless dealers formerly carried on by R. A. Giffen at 30, Chequer Street, St. Albans, as "Giffen's," and that of dealers in electrical fittings, lamps, gramophones, &c. The subscribers (each with one share) are:—L. E. Giffen, 27, Upper Lattimore Road, St. Albans, Herts., solicitor; and Mrs. H. Giffen, "Elmcroft," Beaumont Avenue, St. Albans. R. A. Giffen, Beaumont Avenue, St. Albans, is permanent governing director. Registered office: 30, Chequer Street, St. Albans.

Walker, Crosweller & Co., Ltd.—Private company. Registered November 20th. Capital, £5,000 in £1 shares. Objects: To acquire the business of engineers carried on by J. M. Walker and W. W. Crosweller, at 20, Queen Elizabeth Street, S.E.1, as "Walker, Crosweller & Company." The permanent directors are: J. M. Walker (chairman), Branksome, Mascot Wood Road, Watford, advertising agent; W. W. Crosweller, 76, Westborough Road, Westcliff-on-Sea, engineer. Registered office: 20, Queen Elizabeth Street, S.E.1.

Standard Manufacturing (Wireless) Co., Ltd.—Private company. Registered November 24th. Capital, £400 in £1 shares. Objects: To acquire the business of a manufacturer, supplier and distributor of parts for wireless receiving sets carried on by F. W. Gipson, at 8a, Snells Park, Edmonton. The directors are: F. W. Gipson and A. G. Wedderburn, 142, Shrewsbury Road, New Southgate, N.11. Registered office: 8a, Snells Park, Edmonton, N.

United Electric Lamp Factories, Ltd.—Private company. Registered November 24th. Capital, £100 in £1 shares. Objects: To carry on the business of designers and manufacturers of and dealers in lamps, brackets, shades, motors, dynamos, electrical supplies and fittings, &c. The directors are: A. de Frece, "Redruth," Chislett Road, N.W.6; V. J. Kerr, 25, Bishops Road, Highgate, N.6.

Cleveland Electrical Engineering Co., Ltd.—Private company. Registered November 26th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical, radio and general engineers, makers of, dealers in, and agents for electrical and scientific instruments and appliances, electrical contractors, &c. The first directors are:—C. Harvey, electrical engineer, and Mrs. F. M. Harvey, both of 22, Fitzroy Square, W.1.

Arthur Gray, Ltd.—Private company. Registered November 26th. Capital, £3,000 in £1 shares. Objects:—To acquire the business now carried on at Charing Cross Road, W.C., as "Arthur's," and to carry on the business of dealers in wireless sets and components, electricians, mechanical engineers, &c. The subscribers (each with one share) are:—Rose Gilbert, 17, Handel Street, Russell Square, W.C.1; and L. Tobias, 59, Galloway Road, Shepherd's Bush, W.12, solicitor's clerks. Solicitor: L. Fior, 72, Oxford Street, W.

Shepherd & Co. (Salford), Ltd.—Private company. Registered November 26th. Capital, £500 in £1 shares. Objects:—To acquire the business of manufacturing, repairing, selling and charging electrical storage batteries, electric motors, dynamos and magnetos, and all kinds of electrical instruments and apparatus carried on by Reginald Shepherd at Salford, and to carry on this and the business of manufacturers of, and dealers in, motor cycles, &c. The first directors are:—R. Shepherd, 37, Sussex Street, Lower Broughton, Salford, auto electrical engineer; and H. Loxley, 360, Liverpool Road, Irlam, near Manchester, engineer (both permanent). Solicitors: Ashworth & Inman, 22, Cooper Street, Manchester.

Associated Portable Sound Equipments, Ltd.—Private company. Registered November 26th. Capital, £11,000 in 10,000 8 per cent. cumulative preferred ordinary shares of £1 each and 20,000 ordinary shares of 1s. each. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in, apparatus of all kinds for the recording and reproduction of sound in synchronisation with kinematograph films, manufacturers of, and dealers in, bioscopes, gramophones, loud-speakers, amplifiers, and amplification systems, microphones, electric lamps, high-tension protective apparatus, &c. The subscribers (each with one ordinary share) are:—J. P. Kemp, 11, Richmond Buildings, Dean Street, W.1, engineer; C. H. Davies, 15, Charlotte Street, W.1, kinema technical expert. Solicitors: Bullcraig and Davis, Amberley House, Norfolk Street, W.C.2.

Leslie Fink, Ltd.—Private company. Registered November 22nd. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a manufacturer of, and dealer in, wireless and electrical instruments, apparatus and accessories, &c., carried on by L. Fink at 31 and 31a, Bridge Street, 113, Brunswick Street, Chorlton-on-Medlock, 171, Queen's Road, Harpurhey, all in Manchester, and at 18, Rock Street, Bury. The directors are:—L. Fink, "Sandiway," Okeover Road, Broughton Park, Salford; and J. Fink, 2, Church Street, Cheetham, Manchester. Registered office: 31, Bridge Street, Deansgate, Manchester.

J. R. Halliwell, Ltd.—Private company. Registered October 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c. The directors are: J. R. Halliwell, The Bungalow, Lindow Common, Wilmslow, Ches., electrical engineer (chairman); E. W. Hart, Erlsdene, 22, Whitelow Road, Chorlton-cum-Hardy, Manchester. Registered office: 357, Deansgate, Manchester.

Magic Electric Sound Corporation, Ltd.—Private company. Registered October 29th. Capital, £100 in £1 shares. Objects: To carry on the business of dealers in kinematographic sound installations, electric organs, &c. The subscribers are:—M. de Wolfe, 12, Minster Road, Hampstead, musical expert; W. J. H. Jones, 139, Oxford Street, W.1, clerk. Registered office: 139, Oxford Street, W.1.

Eastleigh Radio Relay Exchange, Ltd.—Private company. Registered December 1st. Capital, £3,000 in £1 shares. Objects: To construct and maintain wireless signal stations, &c. The permanent directors are: A. W. Brown, senr. (managing director), 80, Goddard Avenue, Swindon; W. A. Brown, jnr., 14, Victoria Road, Swindon (manager and secretary of Swindon Radio Relay Exchange, Ltd.); G. W. A. Brown (chairman), "Halcyon," North Stoneham, Southampton; C. W. Harrison, 214, Cranbury Road, Eastleigh. Secretary and manager: C. W. Harrison.

Official Returns of Electrical Companies.

Rawlings Bros., Ltd.—Capital, £100,000 in 30,000 preference and 70,000 ordinary shares of £1 each. Return dated August 20th, 1930. 21,903 preference and 56,401 ordinary shares taken up. £78,304 paid. Mortgages and charges, nil.

Curtis Manufacturing Co., Ltd.—Capital, £6,000 in £1 shares. Return dated August 20th, 1930. All shares taken up. £1,000 paid. £5,000 considered as paid. Mortgages and charges, nil.

Brighton Lighting and Electrical Engineering Co., Ltd.—Satisfaction to the extent of £1,000 on November 7th, 1930, of mortgage dated October 12th, 1922, and registered October 26th, 1922. Mortgage dated November 12th, 1930, to secure £1,000, charged on 10a, 10b and 10c, St. Martin's Place, Brighton. Holders: G. H. Woodman, Balsdean Manor, Rottingdean; and H. M. Woodman, 5, Princes Street, Cavendish Square, W.

West Wilts Electric Light & Power Co., Ltd.—Capital, £150,000 in 10,000 preference shares of £5 and 100,000 ordinary shares of £1 each. Return dated May 22nd, 1930. 5,306 preference and 100,000 ordinary shares taken up. £126,530 paid. Mortgages and charges, nil.

British Insulite, Ltd.—F. A. Pitt, 14, John Dalton Street, Manchester, was appointed receiver on November 12th, 1930, under powers contained in debenture dated July 3rd, 1928.

Essaness Radio & Electrical Co., Ltd.—R. H. Hopkins, Walter House, 418-22, Strand, W.C.2, ceased to act as receiver and manager on August 14th, 1930. (Notice filed November 18th.)

Century Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 30th, 1930. 2,387 shares taken up. £2,387 paid. Mortgages and charges, nil.

Bastian Meter Co., Ltd.—A. Hartley, 76a, Basinghall Street, E.C.2, was appointed receiver and manager on November 17th, 1930, under powers contained in first mortgage debentures dated October 27th, 1926, and March 20th, 1928.

Union Cable Co., Ltd.—Capital, £100,000 in £1 shares. Return dated May 22nd, 1930. All shares taken up. £75,000 paid (being £1 per share on 50,000 and 10s. per share on 50,000). Mortgages and charges, nil.

Elliott Radio Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated July 22nd, 1930. 475 shares taken up. £475 paid. Mortgages and charges, nil.

Lincolnshire Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1929 (filed July 26th, 1930). All shares taken up. £500 paid. Mortgages and charges, £500.

South Somerset and District Electricity Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 19th, 1930. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Brentwood District Electric Installations, Ltd.—Capital, £1,000 in 1s. shares. Return dated June 9th, 1930. All shares taken up. £1,000 paid. Mortgages and charges at date of return, nil. Since registered: Mortgage dated October 15th, 1930, to secure £4,500.

Dyer & Young, Ltd.—F. Rowland, 76, Finsbury Pavement, E.C., was appointed receiver on November 21st, 1930, under powers contained in debenture dated October 14th, 1927.

Restlight, Ltd.—Particulars filed of £4,650 debentures authorised September 11th, 1930, charged on the company's undertaking and property, including uncalled capital and goodwill, the whole amount being now issued.

Bloomsbury Supply Co., Ltd.—Debenture dated October 31st, 1930, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. T. Smith, Premier House, Southampton Row, W.C.1.

Electrical Finance and Securities Co., Ltd.—Satisfaction to the extent of £3,867 on October 31st, 1930, of trust deeds securing debenture stock dated July 29th, 1927, July 6th, 1928, and April 24th, 1930, and registered July 29th, 1927, July 10th, 1928, and April 29th, 1930.

Anderson & Penney, Ltd.—Satisfaction in full on June 16th, 1930, of debenture dated September 25th, 1926, and registered October 7th, 1926, securing £500.

R. J. Richardson & Co. (London), Ltd.—Issue on November 18th, 1930, of £100 debentures, part of a series already registered.

Dynic International Radio, Ltd. (Formerly Mayfair Enterprises, Ltd.).—Satisfaction in full on September 23rd, 1930, of debenture dated July 10th, 1929, and registered July 29th, 1929, securing £1,000.

City Notes.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The annual meeting of this company was held on November 27th. Sir John Ferguson, K.B.E., M.P. (chairman) presided, and in presenting the report and accounts (*vide* ELEC. REV. November 21st, p. 877) said that the large decline in the gross profit—from £208,396 to £96,702—was due largely to the phenomenal fall in the prices of raw materials, involving the writing-down of stocks. Although the Palmer tire business increased its sales, the loss was increased by heavier selling costs. Owing to insufficient turnover, the Burton factory also showed a loss. At Persan the sales had increased but higher overhead expenses had resulted in a greater loss than in the previous year. The profit of their foreign branches showed an increase of £702, but sales were lower owing to the unsettled conditions in Argentina, India and Australia. Referring to items in the balance sheet, the chairman mentioned that negotiations for the sale of the company's cable ship *Silvergray* had been under the directors' consideration several times during the year. The item "Stock-in-trade and stores" was £45,343 lower due to the heavy depreciation written off. They again had to report a decrease in sales by the Silvertown works, although the amount of the decrease was not so large as that of the preceding year. Actually, taking the fall of price levels into consideration, the volume had been slightly greater. The new steam and power plant was completed last February and the anticipated economies had been fully realised. By means of wider advertising motor tire sales had been increased by 30 per cent. Sales of general india-rubber products declined by 5.9 per cent., owing to reduced selling values, and sales of ebonite products had fallen by 4.7 per cent. The greatest improvement among the foreign branches occurred in the case of New Zealand. Dealing with the Persan works, the chairman said that the features of the year had been an expansion of sales, which at times strained the resources, and progress in the modernisation of the factory equipment. Taxation was heavier and there had been unusual depreciation of all kinds of raw materials due to the fall in prices. There was still a great deal to be achieved in the modernisation of the factory and important improvements were now under consideration. The French Government had proposed to levy a duty of four francs per kg. (about 3½d. per lb.) on raw rubber imported from all sources other than French colonies; the latter provided only about 7 per cent. of the total imports. The latest information, however, was that the duty, if imposed, would only amount to 1d. per lb.

Referring to the reorganisation of the company, the chairman recalled that two years ago certain changes were made in the constitution of the board. They immediately began to examine the position of every department and section of the business, but they had to proceed slowly, considering with the greatest care what might be the effect of any action taken in one department upon another. When they had arrived at a full appreciation of their trading position the directors immediately took steps to put into effect a rigorous scheme of reorganisation. In June last one of the directors, Mr. W. F. Lloyd, in whose capabilities the board had the greatest confidence, was appointed a joint managing director. Accounting and clerical sections were amalgamated, office machinery of the most up-to-date kind was installed, and the amount of work was reduced to the minimum compatible with efficiency. The changes had necessitated the discharge of many employés, but had resulted in a substantial reduction in overhead charges. They were easing the burden in the case of discharged employés of long service so far as the funds at their disposal for the purpose would allow. With regard to the producing departments, unprofitable shops had been, or were being, closed down where it was considered that their products could not be manufactured profitably within a reasonable time. Other shops, manufacturing products of a similar nature, were being amalgamated in order to reduce the cost and improve efficiency. The cost of manufacture was being reduced by the introduction of time- and trouble-saving devices, simplifying the methods of production, and by providing a better incentive for the workpeople to co-operate with them, by an extension, wherever possible, of the system of payment by results. In one case this had resulted in the increase of the output per man by no less than 27 per cent. It was not their policy to reduce wages. They believed that the quickest way to reduce the cost of production was to secure the co-operation of their workpeople by allowing them to share in the results, that was to say, lower cost of production and higher wages went together. The large number of dismissals which the various schemes of economy had necessitated applied to the clerical staff and not to those engaged on production, whose numbers were actually being increased. Programmes of work were being arranged at the factories in such a way as to reduce times of delivery, while improvements were being made in the products by the use of better quality materials and better workmanship. With regard to the selling organisation, territories allocated to the various branches were being modified so that they might be worked more economically. Certain branches had been amalgamated in order to reduce expenses (*vide* ELEC. REV., November 21st, p. 864), while at the same time the number of salesmen was being increased. The results of the changes were already evident; the company's sales were increasing on a declining market. Much more had yet to be done, but the results already achieved convinced him that the outlook for the company had very much improved. They regretted to add to the unemployment burden of the country, but the result of their work would be to increase output, and they were confident that before long they would be employing more workpeople.

Replying to questions by shareholders, the chairman said that Mr. Lloyd had the entire support of the board, and it had immediately adopted the proposals which he had put forward. He maintained that the fall in prices could not possibly have been foreseen and the purchasing department was not to blame.

Mr. Lloyd, who also answered questions, said that it was unfair to compare the company, as one shareholder had done, with other electrical equipment companies. They had 215 different products, and cables and wires represented only 7 or 8 per cent. of the total turnover. It was necessary to carry large stocks but a system of stock control was being introduced which would bring about a greater measure of co-ordination. The board was considering the modernisation of the Cannon Street offices, or moving to new premises when the lease expired.

The report and accounts were adopted without dissent, and Sir John Ferguson, the retiring director, was unanimously re-elected.

Jerusalem Electric & Public Service Corporation, Ltd.

The first annual meeting was held in Jerusalem on October 31st. Mr. L. Le Bouvier, the local director, who presided in the absence of Mr. W. Shearer, chairman, read the chairman's speech and said that the company was formed for the purpose of operating a concession authorising the supply of electricity in Jerusalem and district. The construction of the plant was sufficiently advanced to enable a partial supply of electricity to be given on November 3rd, 1929. The installed plant capacity had been selected to deal fully with the anticipated demand in the initial stages of development, but the demand for electricity was such that the board was at present contemplating an extension of the generating plant. The installation of the distribution system had been carried out rapidly. A h.p. ring main now extended throughout the area of supply and l.p. mains had been provided. To date the mains, both h.p. and l.p. comprised approximately 17 miles of overhead lines and 20 miles of underground cable. The number of consumers was over 2,500 and further applications were still being received from hotels and institutions, as well as from the general public for domestic and industrial purposes. They had entered into an agreement with the municipality of Jerusalem for the street lighting of the city and its environs and a similar agreement was contemplated with the municipality of Bethlehem. The report and accounts were adopted.

Lighting Trades, Ltd.

The accounts for the year ended March 31st last show an adverse balance of £17,387, and after deducting £4,435 brought forward, there is a debit balance of £12,951. According to the *Financial Times*, the loss was due in the main to economic depression prevailing throughout the country. During the year under review there has been an association of interests with the Welsbach Light Co., which should provide for greater efficiency in working with a corresponding reduction in selling and administration charges.

Holders of shares not already acquired by Imperial Chemical Industries have received an offer to exchange their holdings for shares of the latter company. For every 25 fully-paid 10 per cent. preference shares of 10s. each in Lighting Trades, Ltd., Imperial Chemical Industries offers eight 7 per cent. cumulative preference of £1 each. For the ordinary shares of 1s. each an offer of 1s. in cash is made. The preference shares of Imperial Chemical Industries to be allotted will rank for the full half-year's dividend, which is payable February 1st next.

Imperial Chemical Industries has also offered to the 5 per cent. preference shareholders of Elliott's Metal Co. to exchange every six of their shares for five 7 per cent. cumulative preference £1 shares of Imperial Chemical Industries.

Burma Electric Supply Co., Ltd.

The annual meeting was held on November 26th, Mr. C. O. Webb (chairman) presiding. In presenting the report and accounts the chairman said during the year under review the business community in Mandalay suffered from a severe depression in trade. These conditions had adversely affected the takings of their tramways and the situation had been aggravated by intense competition from motor-omnibuses. As a result a considerable reduction was shown in the company's earnings during the earlier months of the year. The profit from the supply undertaking showed for the first time for many years a small reduction. This decrease was due to the general depression of trade, and they had no reason to think that when trade conditions improved this side of their undertaking would not continue to expand. During the year considerable progress had been made with the change-over from 500-V to 250-V supply, and they hoped that by December, 1931, this work would be completed. When completed the work would have cost them £40,000. The report and accounts were adopted.

Oxford Electric Co., Ltd.

No interim dividend is to be paid on the ordinary shares. The directors report that the first half of this year has been a period of steadily increasing activity. The terms and conditions of the purchase, by Oxford Corporation, of the portion of the undertakings covered by the Orders of 1890 and 1892 are the subject of litigation and pending the final decision of the Courts, the directors think it prudent to conserve the company's resources, but they anticipate that when a settlement is finally reached, a satisfactory dividend on the ordinary shares in respect of 1930 will be justified.

Aldershot Gas, Water & District Lighting Co.

The *Financial Times* reports that the company is seeking powers to have transferred to itself the undertaking of the Midhurst and District Electricity Co., and also to extend its area of supply in parts of the rural districts of Alton, Petersfield, Dorking, Reigate, East Preston, and Westhampnett. In addition, power is being sought to authorise the creation and issue of capital for these and general purposes. A meeting of shareholders in connection with these proposals is to be held on December 18th.

Allen-Liversidge, Ltd.

A fusion of the company with the British Oxygen Co., Ltd., is being arranged; the two companies have been working in close co-operation for many years. The scheme provides for the purchase of the shares of Allen-Liversidge, Ltd., by the British Oxygen Co. on a share-for-share basis, and is subject to the acceptance of not less than 90 per cent. of the holders of each class of share, preference and ordinary, by December 8th.

Auckland Electric Power Board.

Last week this authority which supplies electricity in an area of 300 sq. miles with a population of about 200,000, published, for information only, particulars of its constitution and objects. This was in compliance with Stock Exchange Regulations in connection with the placing of £100,000 5 per cent. debentures, part of a total authorised issue of £675,000 of which £250,000 has already been raised.

The Third Central Board Issue.

We reported last week that the Central Electricity Board's issue of £6,000,000 of stock was heavily over-subscribed. It was officially stated that applications for about 15 times the amount were received. Applicants for stock to the value of between £100 and £500 were allotted £50 worth; larger applicants were only allotted about 7 per cent. of the amount applied for.

Globe Telegraph & Trust Co., Ltd.

According to the *Financial News*, in declaring the usual quarterly interim of 5s. per share net on the ordinary shares, the directors state that, unless an improvement occurs in the company's income, it will not be possible to maintain this dividend.

Edison Swan Cables, Ltd.

The company has placed £125,000 of 5½ per cent. guaranteed first mortgage debentures privately. These represent the balance of the authorised issue. Principal, interest, and sinking fund, are unconditionally guaranteed by the Edison Swan Electric Co., Ltd.

David Brown & Sons (Huddersfield), Ltd.

The net profit for the year ended September 30th last was £87,159. It is proposed to pay a dividend of 10 per cent., tax free, on the ordinary shares, including 30,000 shares issued during the year, ranking as from January 1st last. The forward balance is increased to £117,287.

Manaos Tramways & Light Co., Ltd.

The report for the year ended April 30th last states that the net operating revenue was £7,987, and after adding interest and transfer fees, and deducting debenture redemption and London expenses, £3,674 is available, which has been transferred to reserve for renewals. Meeting: December 9th.

Northallerton Electric Light & Power Co., Ltd.

At an extraordinary general shareholders' meeting, held on November 28th, approval was given to an agreement for the sale of the undertaking to the Cleveland and Durham County Electric Power Co. at the price of £15,500. The Northallerton Company will be voluntarily wound up.

Shropshire, Worcestershire & Staffordshire Electric Power Co.

It is reported that the company proposes to increase its capital by the creation of 750,000 new 6 per cent. cumulative preference shares of £1 each. The proposal is to be submitted to a meeting of shareholders on December 8th.

Yarrow & Co., Ltd.

The net profit for the year ended June 30th last was £9,696, as compared with £3,319 in the previous year. A dividend of 5 per cent. is recommended (against nil) and £9,670 is carried forward (against £7,474).

Electric and General Investment Co., Ltd.

An interim dividend of 5 per cent. (same) has been declared on the ordinary shares.

British Columbia Power Co., Ltd.

A dividend is announced on the class "A" shares of 50 cents per share for the quarter ending December 31st.

Great Northern Telegraph Co., Ltd.

An interim dividend is announced at the rate of 5 per cent. per annum, less tax.

British Aluminium Co., Ltd.

It is reported that the company has sold to a financial group 700,000 6 per cent. cumulative preference shares of £1 each.

Brazilian Traction, Light & Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been announced on the preference shares, payable January 2nd.

Cable, Telephone & General Trust, Ltd.

It is proposed to change the name of the company to Telephone & General Trust, Ltd.

Stocks and Shares.

TUESDAY EVENING.

YESTERDAY saw the commencement of the last account of the year of grace 1930. Normally an End-December account is always a quiet period, the average investor being too engrossed in buying Christmas presents to have time to consider the purchase of stocks and shares, and this one is likely to prove no exception to the rule. A hardening-up in money rates, which is also a normal accompaniment to the year-end, caused a little hesitation in the gilt-edged market, but this is likely to be short-lived as rumour is toying with the possibility of a reduction in the Bank Rate after the turn of the year. The news regarding the coal situation had very little effect on the Home Railway market which was quiet and steady. The Miscellaneous market threw up no feature worth recording, a steadying influence being the momentary cessation of selling from the Continental bourses. The various international counters were also very quiet, in sympathy with New York. One of the brightest spots was the Oil market, where sharp movements in favour of holders were experienced following the reassuring speech made by Sir Henri Deterding at the Royal Dutch Company's meeting in Amsterdam. Rubber itself was harder at 4¾d. per lb., but had very little effect on the price of the shares as the reduction in stocks to the tune of 337 tons last week was under general expectation

Central Electricity Board Dealings.

The outstanding feature of the Electric Lighting market during the past week was the commencement of dealings in the £6,000,000 4½ per cent. stock of the Central Electricity Board. This issue was one of the biggest successes of recent months, being applied for some 15 times over. Dealings started on the basis of ¼ premium and the price rose to, at one time, ¾ premium from which level it subsequently reacted, profit-taking on the part of stags being more than sufficient to supply investment demand. Once the quick-turn operators are out of the way the price is likely to harden up considerably, as the market is distinctly short of stocks in this category. This issue came in for a good deal of publicity in the Press, and this drew attention to the merits of the lighting market in general where business continued to be very active—in fact, it can probably be said that with the exception of the gilt-edged market, the market for electric light and power shares is the only active one at present on the Stock Exchange. As will be seen from our list of prices a good many changes were recorded and they were in every case in favour of holders. Egham & Staines ordinary enjoyed a rise of between 4s. and 5s. at 37s. 3d., to the accompaniment of rumours of the possibility of acquisition by a larger concern, and Bournemouth & Poole were the best part of 3s. up at 62s. 9d., on talk of that part of the undertaking which is within the province of the Corporation of Bournemouth being acquired. Practically the only share that has not participated in this upward movement is Scottish Power, the old ordinary remaining at 30s., and the new at 28s. 9d., at which price the yield is practically 5½ per cent.—some shillings higher than can be obtained on any of its contemporaries. As it is understood that the company has done very well during the current year there appears to be scope for appreciation here. Dealings have now commenced in the recently-issued 6 per cent. preference shares of this company, and these are available at the moment at 23s. 6d., free of stamp and fee. Payment is for

December 30th and a full six months' dividend will be paid on August 1st next. The dividend is covered some three times over on 1929 profits. Since then, over £1,000,000 of new money has been put into the business, the revenue from which will materially increase this cover, in view of which the shares are likely to be quickly absorbed by the investing public, as it is practically impossible to obtain a yield of higher than 5 per cent. on the preference shares of this group. For instance, at the moment the only other preference share available in any quantity is Yorkshire Power 6 per cent. preference, for which 25s. is required and on which the yield is only £4 16s. per cent. Criticism is raising its voice in connection with the private issue of 750,000 6 per cent. preference shares by the Shropshire, Worcestershire, and Staffordshire Electric Company, it being contended that existing proprietors should, in all cases, be given the first opportunity of putting up new money. In this case, however, the question hardly arises as the equity of the Shropshire Company is held by the Greater London and Counties Trust. Investment demand continues in the group of companies operating under the London Electricity Acts, 1925; the preferences of this group were also quickly absorbed whenever they came to market, the demand always exceeding the supply. One or two moderate-sized parcels of North-West Midland Joint Electricity Authority 5 per cent. stock changed hands round about 104 which is the price at which practically the whole of the 5 per cent. debentures of Home Supply companies are now standing, almost the only exception being Hendon Electric 5 per cent. stock which is called 102, and at this price taking into account the fact that a full half-year's interest is payable on January 1st next, this gives a full 5 per cent. interest covered five times over. The unusual procedure—for a lighting company—of postponing the consideration of an interim dividend has been adopted by the Oxford Electric Company in view of the uncertainty as to the conditions under which the undertaking will eventually be taken over by the local authorities.

Tokyo Electric 6 per cent. bonds were not affected by the news of the Japanese earthquake and continue in investment demand around 96. As the area of supply of this company is 50 per cent. larger than the area of the whole of Wales, and as the 1923 earthquake, which was the biggest of its kind in living memory, only resulted in this company temporarily reducing its ordinary dividend from 14 per cent. to 11 per cent., the earthquake risk in connection with these first mortgage bonds must be negligible. At the present price, giving as they do a yield of 6¼ per cent., covered four times over, the bonds appear quite attractive for mixing purposes. Of other companies operating overseas, Calcutta Supply, at 47s. 6d., were in demand on the excellent progress statement, but the other Indian concerns were conspicuous by their absence. The "A" and "B" stocks of British Columbia Power Corporation continued inactive.

Active Underground Ordinary.

The continued good traffics of the Underground combine are reflected in increased activity in the £1 ordinary shares of the Underground Electric Railways of London, which retained all their previous rise. The operating companies were also a little more active. London United Tramways preference changed hands at 3s. 9d., the 4 per cent. debenture stock was in investment demand at 55, and London and Suburban preference were called 11s. There was no change in the securities of the British Electric Traction Company, and of the operating companies, all the Hants and Dorset preference shares have now been absorbed and dealings have commenced in Southdown Motor Services new ordinary shares around £2 premium. Of overseas companies, Brazilian Traction moved within very narrow limits and the only change to record in the securities of the Anglo-Argentine Tramways Company was a drop of 5s. in the £5 second preference to 30s., on fears that the half-yearly dividend normally payable in January next will not be forthcoming. If it is forthcoming the yield at the present price will be the exceptional one of 20 per cent.

New Cable Issue.

Dealings are now taking place in the £125,000 Edison Swan Cables 5½ per cent. first mortgage debenture, stock being offered at 100½ free of stamp and fee. This debenture carries the guarantee of the Edison Swan Company and is therefore first-class of its kind. Globe Telephone ordinary slumped sharply to 13⅜ on the announcement that, although the usual quarterly dividend of 5s. a share would now be paid, it would not be possible to maintain this dividend in the future unless there was an improvement in the company's revenue. The three stocks of the Cables & Wireless combine displayed a hardening tendency in spite of the dismal October traffics, interest being taken in the "B" stock as a long-pull lock-up. Price movements in the manufacturing concerns were few and far between, practically the only two worth mentioning being G.E.C. ordinary, which at 47s. 6d. were 1/16 up, and Crompton Parkinson which added 1s. to their quotation at 21s. 9d. The recently-issued 5 per cent debenture stock of the General Electric Co., Ltd., continued in investment demand and cannot now be obtained under 102¼. The success of the Central Electricity Board issue drew attention to the merits of the various cable manufacturing companies without, however, affecting the prices.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Dec. 2 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	8 1/16	+1/16	4 17 7
Brompton Ordinary	1	8½	8½	27/6	+6d.	6 3 8
Charing Cross Ordinary	1	8½	8½	29/-	+6d.	5 14 0
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	27/6	+6d.	6 9 5
City of London	1	10	10	35/-	—	5 14 8
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	36/3	—	4 8 3
County of London	1	7	10	50/-	—	4 0 0
do. do. 6% Pref.... ...	1	6	6	24/6	—	4 18 0
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/9	+1/8	4 10 0
Kensington Ordinary	1	8	8	27/6	—	5 16 5
Lancs. Light and Power	1	7½	7	25/6	+6d.	5 9 10
London Electric	1	8½	9	33/-	+1/-	5 9 1
Metropolitan	1	9	10	2 7/16	+1/16	4 10 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	7	23/6	—	4 18 3
Mid. Elec. Power	1	15	8	31/8	—	5 2 5
Newcastle-on-Tyne Ordinary ...	1	6	6	25/-	+1/8	4 16 0
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6		10⅜	—	5 11 4
North Met. Elec. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	28/-	—	5 14 4
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	27/-	—	6 5 11
Urban Ordinary	1	7	7	29/6	—	4 15 0
Westminster Ordinary	1	8½	8½	28/6	+6d.	6 3 6
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	34/6	—	4 12 9

Home Rails.

Central London Ord. Assented ...	Stock	4	4	79	—	5 0 9
Metropolitan	,,	3½	4	69	—½	5 16 0
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	7	8	24/6	—	6 10 8
do. do. Income ...	Bonds	6	6	104	—	5 15 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 7
do. Def.	,,	1½	1½	25½	—	5 17 8
Automatic Telephone	1	10	12½	35/-	—	7 2 10
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	72½	—	7 11 9
do. A 7½ Ord.	,,	—	—	22½	—	... ...
do. B Ord.	,,	—	—	12	—	... ...
Globe Tel. and T. Ord.	10	10	10	13⅜	—1⅛	7 9 6
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	1 15/16	+1/16	7 15 0
Oriental Telephone Ord.	1	12	12	2⅜	—	*5 1 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	1⅞	—	14 13 4
do. do. 2nd Pref. ...	5	6	6	1⅜	—⅛	20 0 0
do. do. 5% Deb. ...	Stock	5	5	50½xd	—	9 19 0
British Electric Traction Def. Ord.	,,	5	5	1425	—	... ...
do. do. Pref. Ord.	,,	8	8	127½	—	6 5 6
Brazil Traction	100	7	8	26½	—	... ...
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	90½	—	5 3 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/-	—	... ...
London United Tram Deb. ...	Stock	4	4	54½	—	7 6 10
Mexico Trams, 5% Bonds	—	5	5	59	—	8 9 6
Mexican Light Common	100	Nil	Nil	50½	—	... ...
do. 7% Pref.	100	7	7	73½	—	9 8 0
do. 1st Bonds	—	5	5	78	—	6 8 3
Victoria Falls Ord.	1	15	15	58/9	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	22/-	—6d.	5 9 1
Babcock & Wilcox	1	13	15	52/6	—	*5 14 8
British Aluminium Ord.	1	10	10	33/9	—	6 18 6
British Insulated Ord.	1	15	15	8½	—	4 12 4
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	8½	—	4 16 0
do. 6½% Pref.	1	6½	6½	25/-	—	6 4 0
Crompton Parkinson Ord.	5/-	—	30	21/9	+1/-	6 17 11
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st. Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	23½	—	5 19 8
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4¼	—	5 17 8
English Electric	1	Nil	Nil	11/3	—	... ...
do. do. Pref.	1	8	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	31/-	—	6 13 4
Gen. Elec. Pref.	1	6½	6½	26/-	—3d.	5 0 0
do. Ord.	1	10	14	47/6	+1/8	5 17 11
Henley	1	25	30	6	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	6/8	—	... ...
Johnson & Phillips	1	10	10	13	—⅛	5 14 3
Siemens Ord.	1	7½	7½	21/8xd	—	7 1 2
Telegraph Construction	15	10	10	17½	—	*6 18 0

* Dividends paid free of Income Tax.

A New Meter Factory.

Notes on the equipment and operations at the recently-established works at Enfield of the British Sangamo Company, Limited.

AFTER having carried out the manufacture of its products in a factory at Ponders End for about ten years, the British Sangamo Co., Ltd., has, as the result of business growth, erected a large and up-to-date factory of its own on the Cambridge arterial road at Enfield for the manufacture of electricity supply service meters of all descriptions. The factory is a two-storey building and has 34,000 sq. ft. of floor space. It stands on a site of approximately 10 acres of ground, and is so designed that future extensions may be made readily. The building, fig. 1, which is of cubic design and forms a landmark in the surrounding district, is constructed on modern fire-proof lines, the walls being of brick, white rough-cast on the exterior, and the floors, both up and downstairs, being of concrete, faced with a specially hard dustproof material. Well-kept lawns and flower beds in front of the building create a favourable impression upon the visitor.

Fig. 1.—General View of British Sangamo Works.

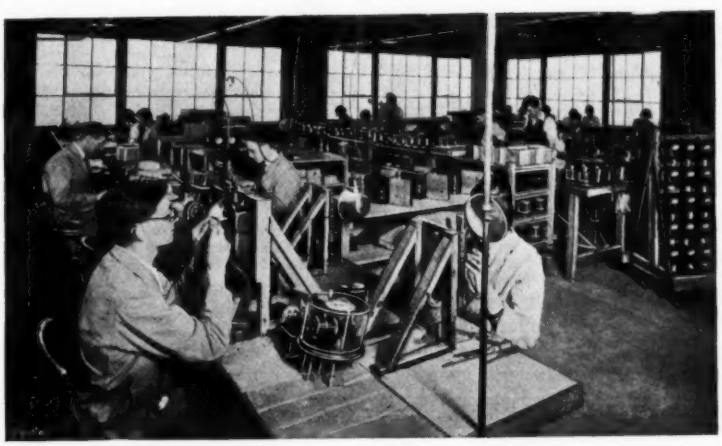


Fig. 2.—The Meter-assembly Department.

Much of the work carried out in the factory is the manufacture of small parts, and the consequent essential cleanliness is obtained by means of the dust-proof flooring and an efficient staff of cleaners. Fig. 2 is a general view of the meter-assembly room.

On the ground floor are the machine and tool rooms. The former is equipped with the latest types of multiple drills; one machine, for example, will drill 25 holes and operate in four directions simultaneously. The paint shop, which is equipped with spraying, impregnating, and vacuum drying plant, is also at the ground level. A very large section of this floor is devoted to the stocking of parts of the various types of meters in large quantities. The more bulky parts are stored on sliding shelves in dust-proof cupboards, and it is arranged that after each main operation the parts are returned to the stores for issue or re-issue to the department or section performing the next operation. By this means an accurate record of production and stock at each stage is kept. A shipping section and the generator room complete the ground-floor layout. The generator equipment is designed to provide varying voltages and periodicities for test work. A three-phase a.c. motor is coupled to a d.c. generator which supplies a series of direct-current motors coupled to alternating-current generators.

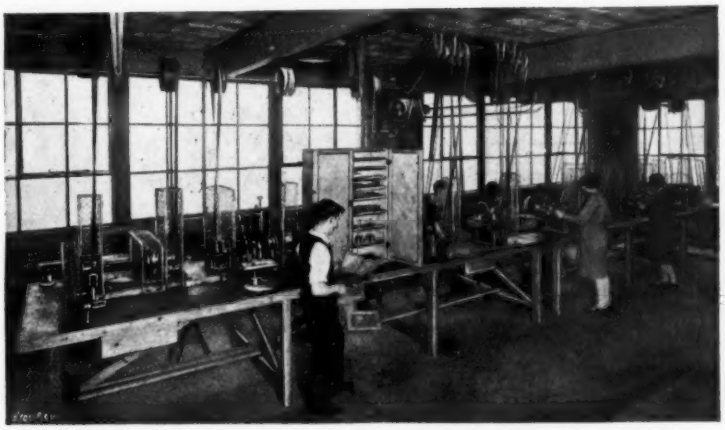


Fig. 3.—Small Gear-cutting Equipment.

On the first floor are large airy offices, the light-machine room and assembly department, and a test room laid out to provide for all the usual methods of testing completed meters and meter mechanism, and for very accurate testing in connection with the production of standard and sub-standard instruments. An interesting feature of the testing routine is the treatment of meters in a strong rotating field. In this connection the rotation of the disk of the meter under test is compared stroboscopically with that of the disk of a standard or master meter. It is interesting to note that this test is one of three in which individual attention is given to each product of the factory. Fig. 4 shows some of the meter-testing benches. In the design and assembly of the meters every consideration is given to providing for easy removal of the mechanism and access to the working parts. Consequently, on delivery of a consignment of meters to the meter test room or the customers' premises, the meters may be readily taken apart and inspected, re-assembled and put into service at a rate which does not represent a burden so far as cost is concerned, and which operation, due to the design of the meter to very fine limits of manufacture, can be carried out without risk of alteration so far as accuracy is concerned. The meter train is fixed by two clips, and it can be removed and replaced without the use of any tools. Removing three screws enables one to take out the cast-iron grid carrying the rotor, train, and permanent magnets, thus leaving the electro-magnetic system and connection readily accessible. When the train has been removed, the top and bottom bearing can be screwed out and the complete rotor removed without affecting any of the adjustments; thus both pivots and jewels are readily replaceable.

It is not possible to deal adequately in these notes with the

many delicate operations carried out in the works, suffice it to say that the visitor touring the works is strongly tempted to lag before such speedy and fascinating processes as the assembly of the train gears and the mounting of the meter jewels. The latter, by the way, are synthetic products, and are claimed to be superior for their purpose to natural stones. The

Fig. 4.—Routine Test Benches.

company has recently started to produce its own train wheels, and fig. 3 shows the installation put down for this purpose.

A word should be said as to the attention given to the comfort and welfare of the workers. Well-equipped first-aid and dining rooms, and so on, suggest that everything possible is done in this connection, but, what is perhaps a more accurate indication, cheerfulness prevails everywhere.

Nickel Plating.

Notes on anode purity and the consequent troubles, and on the "Depolarised" (depassive) anodes recently introduced in this country.

DURING the last decade a considerable amount of research work has been carried out in electro-deposition of nickel, and by a natural development such research has led to a study of the behaviour of anodes, and particularly

Fig. 1.—Samples of Irregularly Wasted Nickel Anodes.

the phenomenon known as passivity, one of the factors which cause trouble with anodes of high purity. The problem is more important now than formerly, since the very considerable improvements in the refining of nickel have enabled anode manufacturers to place on the market anodes of altogether higher standards of purity than were formerly possible. The use of impure anodes in former years caused a considerable number of plating troubles, but these anodes had at any rate one advantage over the high-purity material, in that passivity was practically unknown, since the presence of impurities, particularly of certain types, does unquestionably promote free solution or corrosion of the anode. Indeed, some anode makers, particularly in America, deliberately added impurities in order to achieve this freedom of solution.

Obviously, however, such methods of dealing with the problem of anode corrosion are thoroughly unsatisfactory, and may now be considered entirely obsolete. The standard of purity of the modern anode has for some years been 99 per cent., and often typical samples have assayed as high as 99.5 per cent.

Such a metallurgical advance forced renewed attention to the problem of passivity, for this problem is further complicated by the fact that even where passivity is not very pronounced there still remains trouble more or less serious, due to the way in which disintegration of the anode takes place. Such disintegration is usually accompanied by the formation of a black sludge consisting mainly of nickel oxide and basic compounds formed by the action of impurities, and these formations are of course cumulative in their action.

These troubles vary considerably, according to the chemical composition of the solution, and to external conditions such as temperature and current density, but the problem became much more acute when the employment of warm agitated solutions became common practice.

When the solution is violently agitated from the bottom the whole mass of sludge and metallic particles is distributed very uniformly all through the solution with very damaging results. The difficulty is partially overcome in modern practice by the use of anode bags, which restrain the free movement of the sludge, and by constant automatic filtration of the solution.

The wastage of pure anodes is irregular, excessive and expensive. After a few weeks' wear they become thin, and whole scales and plates drop away, fig. 1. There seems to be no authentic figures on which to base a calculation, but expert estimates of actual loss and waste of pure nickel through irregular corrosion put it at from 5 per cent. to 10 per cent.

The main problems to be solved in connection with anodes then were to secure purity without passivity, uniformity of corrosion, and total solubility.

For some time now in the U.S.A. they have solved all these problems to their own satisfaction by the use of what are termed "Depolarised" (depassive) anodes, and as these have now been introduced into this country and are readily obtainable, an account of their properties is not without interest and value. Messrs. W. Canning & Co., Ltd., have the sole selling rights for the British Isles for these anodes.

The anodes are claimed to be remarkable in their performance, and to dissolve clearly away to a rod of icicle shape and almost icicle texture, fig. 2.

Whatever be the chemistry of the action, certainly one point is of the greatest importance; these anodes do not function properly unless there is a chloride—or at least a halogen—in the solution. From the anode point of view it is immaterial whether the chloride is of nickel or ammonia; but it must be there to an extent equivalent to at least 25 grams of crystallised nickel chloride per litre of solution (4 oz. per gal.).

However, practically all modern rapid nickel solutions contain this ingredient, and the point is only raised as of

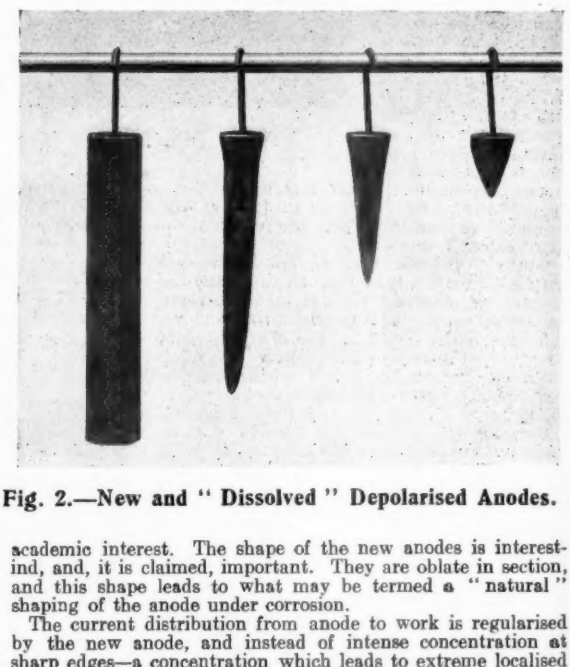


Fig. 2.—New and "Dissolved" Depolarised Anodes.

academic interest. The shape of the new anodes is interesting, and, it is claimed, important. They are oblate in section, and this shape leads to what may be termed a "natural" shaping of the anode under corrosion.

The current distribution from anode to work is regularised by the new anode, and instead of intense concentration at sharp edges—a concentration which leads to extreme localised corrosion—action is equally spaced and corrosion uniform.

It is believed that these anodes will be as popular and as valuable in England as they have proved to be in the U.S.A.

Small Induction Furnaces.

Very-high-frequency induction furnaces for laboratory work, employing water-cooled oscillator valves, are a recent development of the Metropolitan-Vickers Electrical Co., Ltd.

IN addition to the larger coreless induction furnaces of improved design developed by the Metropolitan-Vickers Electrical Co., Ltd., for melting iron and steel and non-ferrous metals in commercial service, the company has also developed small induction-furnace equipments which are particularly suited to laboratory work. The latter development was carried out originally to meet the needs of the company's own research work, but similar equipments have since been

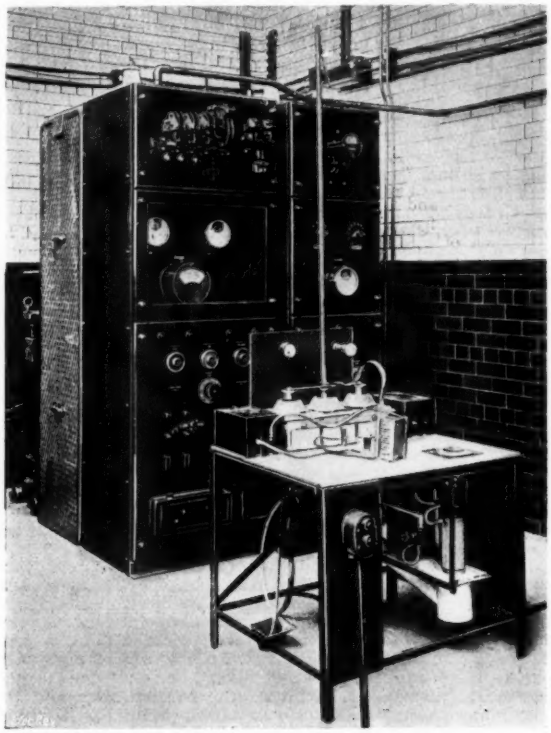


Fig. 1.—Small Electric Induction Furnace at Manchester University.

supplied to the universities of Manchester and Sheffield and have been in successful operation for some time. A furnace of similar type, but of somewhat larger size, has now been ordered by Imperial Chemical Industries, Ltd., for use in the research laboratories of the works of Brunner Mond & Co., at Winnington. This equipment is designed to melt a charge of 20 lb. of metal and is rated at 20 kW. The equipment supplied to the University of Manchester is designed for a charge of ½ to 2 lb. and is rated at .5 kW. Two equipments at Sheffield University are of rather smaller size and are used for melting charges of a few hundred grams of metal in vacuo. In each case the supply of power at high frequency for operating the furnace is obtained by means of a water-cooled oscillator valve. The development has thus an additional interest as an example of the use of thermionic valves for industrial work.

The use of an oscillator valve which gives a frequency of about 500,000 cycles enables the furnaces to melt very small charges. While it is possible to melt a ¼-ton charge of steel with power at 500 cycles, charges of a few grams require very much higher frequency. In laboratory furnaces, especially when working with rare or costly metals, it is very desirable to be independent of any size restrictions imposed by purely electrical considerations, and so it is essential to provide a frequency which will melt all charges from a few grams up to several pounds. The furnaces will melt charges of up to ½ lb. in two to three minutes, and normal full charges are melted in 20 to 30 minutes. All the furnaces will melt quantities up to about twice their normal charges, provided that correspondingly longer times are allowed for the operations. The only limit to the temperature attained in small charges is that imposed by the melting point of the refractory container, and within this restriction any metals can be melted. So great is the rate of energy input that a ¼-lb. charge of steel will actually evaporate if left in the furnace field for five minutes. The power consumption on the larger charges of steel is only about 0.5 kWh per lb. of charge, and correspondingly less for metals of lower melting point.

Fig. 1 shows the furnace equipment installed at the Manchester University, while fig. 2 shows a 10-lb. ingot of steel being poured from a furnace in the Met-Vick Research Department. In each case the furnace proper consists of a water-cooled coil within which is placed a crucible containing the metal to be melted. In fig. 1 the coil is shown on the table, while in the larger sizes it is embodied in the tilting gear. In addition to the actual furnace coil, fig. 1 shows also the incidental equipment, which consists of a high-frequency valve-oscillator set and a three-phase valve rectifier set, together with control gear, indicating instruments and protective devices. The right-hand cubicle contains the water-cooled oscillator valve, together with its associated high-frequency and filament supply circuits. On the front of the panel are a voltmeter, a rheostat for the valve filament circuit, and tapping switches for varying the inductance of the grid coil to suit that of the furnace coil which is being used.

The left-hand cubicle contains the three-phase valve rectifier unit, to which power is supplied at 10,000 volts by a transformer installed behind the cubicle. At the top of the panel are the main contactor and the filament circuit contactor, which are operated by means of the push-buttons seen below. The high-pressure supply is alternatively controlled by means of the push-buttons on the furnace table. The panel also carries a filament voltmeter and rheostat, a voltmeter and

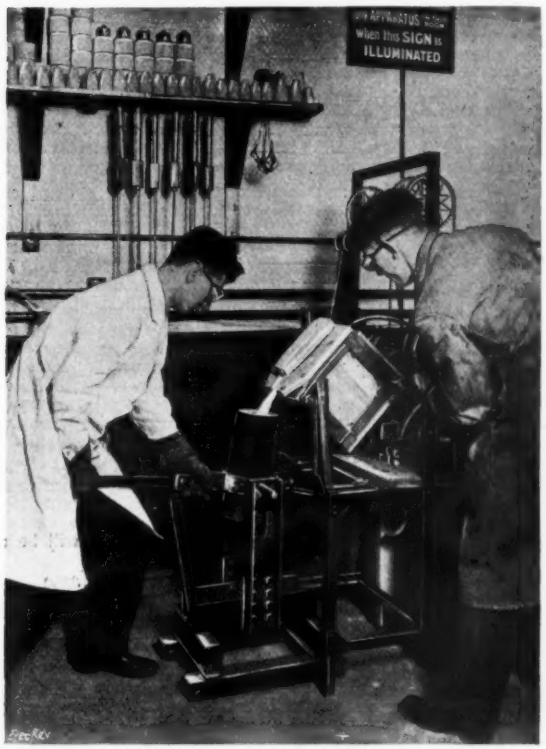


Fig. 2.—Pouring a 10-lb. Steel Ingot from a Small Induction Furnace.

ammeter for the high-pressure current, and the protective relays. At the back of the furnace table are the tuning condensers and a panel on which are mounted a neon lamp which indicates when the set is oscillating, and an ammeter which shows the current in the oscillatory circuit. The provision of a complete set of indicating instruments adds considerably to the usefulness of the equipment, as it enables the conditions to be checked and reproduced when required. The protective devices include a filament voltage relay which protects the rectifying valves by preventing the application of the high-pressure supply unless the filament voltage is at a

correct value. Each rectifying valve is individually protected by an overload relay, these relays also serving as a general protection against overload on the equipment. A relay is provided in the water-circulation system which trips the contactors of both the main and filament circuits in the event of failure of the water supply. The equipment is thus self-protecting, and the operator is enabled to give his undivided attention to the metallurgical aspect of the work. A vacuum pump equipment forms a useful accessory to the set, enabling melts to be made in vacuo. The pump equipment is conveniently installed beneath the furnace table, as shown in fig. 1, thus facilitating connection with a short pipe and the minimum of jointing. The equipment can also be easily arranged for making melts in an atmosphere of inert or other gases.

Furnaces of this type have been satisfactorily used for a variety of research work. An example is an important investigation carried out at Sheffield University on the influence of zirconium upon metals with which it is alloyed. A description of the work done and the equipment used in this investigation is given in a paper which has been read before the Institute of Metals.* It is interesting to note that the weight of the alloys agreed so closely with the weight of the constituent metals (within 0.3 per cent.), that charges as small as 10 to 30 grams could be used without sacrificing the accuracy of the work.

* "The Alloys of Zirconium," by T. E. Allibone, M.Sc., Ph.D., and C. Sykes, M.Sc.

Three-phase Metering.

Some of the Inaccuracies Introduced by Auxiliary Apparatus and Special Fitments.

By OLIVER HOWARTH, A.M.I.E.E.

(Extracts from a paper read before the METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IT is recognised that accuracy has a commercial value, *i.e.*, there is an economic limit to the amount of money which may reasonably be spent in order to reduce the error by, say, 0.25 per cent., which limit will vary with the magnitude of the supply and the price charged. It is a sound policy to eliminate all known errors so far as is practicable, however small they may be, because there will remain errors which cannot be eliminated.

In some of the modern developments of switchgear design the requirements of accurate metering have been overlooked. Class C (B.S.S. No. 81—1927) current transformers to operate meters are incorporated in switchgear, whilst even a Class B transformer may introduce serious errors. Even to-day the metering current and potential transformers may be called upon to operate indicating instruments and protective gear, in spite of the additional errors introduced. Too many engineers regard the errors allowed in British Standard Specifications as normal, whereas they are really maximum errors. Most British meters can be adjusted to within half the limits allowed in B.S.S. No. 37—1930, and it is unfortunate that this achievement of meter manufacturers is often impaired by unsatisfactory instrument transformers and unsatisfactory arrangements of secondary connections

Most maximum-demand indicators available at present are unsatisfactory. B.S.S. No. 37 (Electricity Meters) does not cover them, and it is doubtful whether B.S.S. No. 89 (Indicating Wattmeters, &c.) covers them. The appropriate specification for a Merz-pattern indicator is B.S.S. No. 37, and it is unfortunate that these instruments were not included in the recent revision of that specification.

Assuming that the errors in practice are only half those allowed under the usual maker's guarantee (a reasonable assumption, judging from the author's experience), errors up to 3 per cent. in the reading of a demand indicator with ¼ load on the meter are to be expected. It is not at all uncommon for meters to be operating at ¼ load and below for considerable periods.

The importance of accuracy can best be realised by considering an ordinary industrial consumer having a maximum demand of 1,000 kW and a load factor of 25 per cent. who pays a monthly kilowatt charge at the rate of £3 per annum per kW and 0.3d. per unit; his monthly account will be as follows:—

1,000 kW at 5s. per kW	£250
183,000 units at 0.3d. per unit	£229
Total	£479

Thus an error of 3 per cent. in the demand indicator is quite as serious financially as an error of 3 per cent. in the energy measurement, yet the latter is outside the British standard limits and the former may be well within.

The above criticisms of maximum kW demand indicators apply also to kVA demand indicators operating on the Merz system. The author suggests that, whilst the assumption of constant voltage may be satisfactory for a domestic, or small, supply when the demand charge is a small one, it can hardly be considered satisfactory when the demand charge amounts to hundreds or thousands of pounds per annum.

The two types of kVA maximum-demand indicators which make the most complete measurement are the Hill-Shotter voltage-compensated pattern and the "Trivector" meter. The former has a rather short working range, and the latter has a quantity of complex gearing. Probably the most satisfactory method of making the measurement is that adopted by the Central Electricity Board, *i.e.*, by recording the kW and reactive kVA during each period and afterwards calculating the kVA from the chart records.

With the advent of the thermal-storage electrode boiler there will be a demand for a 4-wire high-voltage meter. The induction-type meter holds the field for a.c. supplies. The most accurate method of metering a low-voltage 3-phase supply when the neutral point is available is by means of three single-phase meters. When the maximum demand must be measured a 3-phase meter becomes essential. The cost of three meters is slightly higher than the cost of one of the same rating, but when the supply undertaking's testing costs are added, three single-phase meters are less costly than a 3-phase 4-wire meter. There is also a gain in the smaller number of types and sizes to be stocked, which results in less capital being required to cover the stock. Where the supply is 3-wire and the neutral point is not available, a 3-phase 3-wire meter is more satisfactory than two single-phase meters, for two reasons. One is that the reverse registration of one of the single-phase meters on low power factor causes confusion in the accounts department and leads to errors in reading the meters. The other reason is that the meter which registers backwards may be very inaccurate when doing so, owing to the friction compensation being adjusted for forward registration.

Apart from the conditions just discussed, the single-phase meter is inherently more accurate than the 3-phase meter. The errors likely to arise due to mechanical defects are still with us, and there is still room for improvement in the temperature errors of induction meters. Three-phase meters are liable to the same errors as single-phase meters, plus additional errors due to the increased friction on account of the heavier rotor and the maximum-demand indicator mechanism when one is incorporated. It is now possible to obtain 3-phase 2-element meters with a negligible amount of interaction between the elements, so that errors due to this may be avoided. It should be borne in mind that a 4-wire meter is more likely to have to register unbalanced loads than a 3-wire meter, and, whilst a meter having considerable interaction can be compensated during calibration for a balanced load with definite phase rotation, it is not possible to compensate for all conditions of unbalance which may occur in service. When the supply is given from a sub-station on the consumer's premises the 2-element meter will give more satisfactory results if the choice of meter is limited to those incorporating a maximum-demand indicator. It is not suggested, of course, that manufacturers who do not supply meters incorporating maximum-demand indicators can furnish a more satisfactory meter than those who do.

Accurate testing calls for a high degree of manual skill, and in the interests of accuracy it is advisable to keep the number of measurements down to the minimum. In planning the calibration and testing of meters, either of two principles may be adopted. The meter may be adjusted to be accurate over the range and under the conditions which will obtain when it is in service, or it may be adjusted to be accurate over its full range and under all conditions which may possibly obtain in service. The latter is likely to give the most satisfactory all-round results. Regard must also be paid to the comfort of the testing staff, as accurate work cannot be expected in a vitiated atmosphere or a cold room. A temperature or 60 deg. F. is a reasonable compromise, and is probably a fair average of the ambient air temperature in service, while tests show the importance of energising the pressure coils for a period of at least two hours prior to making a test. Most manufacturers are extravagant in the allowance they make for overloads in the demand-indicator scale, and this militates against accuracy at normal working loads on the meter.

The author expresses his indebtedness to the management of the Lancashire Electric Power Co. for permission to publish data obtained in the course of his duties.

Electric Power Supply.

Some Economic Reflections Bearing on Conditions and Requirements in Rural Areas.

By A. G. COLLIS, M.I.E.E., M.A.I.E.E., C.C.

(Extracts from a paper read before the OVERHEAD LINES ASSOCIATION, *London.)*

SUCH rigorous criticism as has been directed to the capital cost of switchgear generally emanates from a prejudiced, or an incompetent, survey in the determination of expenditure, without any direct knowledge of the complexity of the service. Skilful manipulation in the design and application of switchgear will reduce the capital cost of any complete installation to the minimum, having due regard to its importance in maintenance and its effective control, upon which the success, or failure, of any scheme depends. It is necessary to emphasise the importance of this matter and to grasp the fact that the cost of switchgear is a comparatively small portion of the complete capital cost of any installation.

Transformers.—Discrimination is necessary for selection. By the use of auto-connected power transformers the savings effected in comparison with those of the double-wound pattern are approximately 40 per cent. in losses and 35 per cent. in capital costs. Their use is generally confined to long trunk feeders for stepping down to a distributing network at 11,000 volts. Their flexibility and economy are sometimes preferred, irrespective of the technical difficulties surrounding their use. It is well to remember that by using transformers wound for 11,000 volts only, instead of series-parallel, say, 11,000/22,000 volts, there is a saving of 10 per cent. in losses with an average of 40 per cent. saving in capital cost.

The losses due to light load by reason of low power factor are apparent, and serve to illustrate the large amount of unconverted idle current resulting from incorrect application in practice. Assuming there is a no-load characteristic on the transformer, the no-load losses are supplemented by an increased cost of approximately one-third, due to low power factor, which is apart from the effect on the stability of the circuit and the increased loss to revenue account. The employment of transformers of the least capital cost does not necessarily result in the most efficient conversion of energy; in fact, by a careful analysis of the character of the load and the ratio of copper to iron losses, a considerable saving in the use of a transformer may be effected.

Many engineers divide service into two sections, power and distributing transformers, ratios 2/1 and 3.5/1, respectively. It is suggested that they should be divided into three sections (light, light and power, power) and that in the case of rural distribution greater economies are effected by increasing the number of transformers with a corresponding decrease in size per area of distribution, which on investigation improves its load factor. A transformer having smaller iron loss than copper loss is less costly on light loads, but its capital cost is increased on lighting work; for rural distribution low iron loss operating on small loads requires a transformer with a larger capital cost. It is, therefore, necessary that the performance figures be considered with capital cost in order that efficiency may be the greater in the interests of economical supply.

Rotary Convertors and Synchronous Machinery.—It may be found on an existing d.c. service network that a change-over to a.c. is better accomplished by connecting such services in sections with h.p. a.c. trunk feeders, the conversion being confined to automatic rotary sub-stations. Several such installations are in operation which have contributed to a reduction in the cost of energy, and in one case to an additional saving in labour and attendance, apart from the labour released being turned to remunerative operations with a vast improvement of service and constant pressure at all loads on consumers' premises. The full-load efficiency of the equipment averages 94.6 per cent.

A.c. conversion can be made most economical by the application of automatic power-factor-correcting plant, involving auto-synchronous motor-generator sets when energy is charged for on the rebate principle.

Short Circuits and Surges.—It is necessary for discriminative purposes to realise the values of short circuits and the amount of energy that may flow into them in a period of time. It is sometimes expedient to introduce a form of current-limiting device to enable the circuit to be opened without disturbing, or the failure of, the apparatus connected thereto. Its use, however, requires considerable thought and discretion for its most effective employment. Any increase in the total reactance of a circuit might establish resonant conditions in combination with the capacity of the system which, in effect, may introduce excessive pressure surges on the appearance of a fault. Reactors may be introduced with economy to suit the kVA capacity of the existing switchgear, obviating dislocation of the system and the expense of entire replacement of existing designs.

It may be presumed in a large number of cases that surge effects are the consequence of switching operations, and many breakdowns of insulation are certainly due to this cause. In general, inductance acts like an open circuit in the first instance and finally like a short circuit; capacity acts like a short circuit in the first instance and finally as an open circuit. Although switchgear is considered a compulsory evil, it is the most important, least expensive, and most economical link in any transmission line. While the closing of circuits introduces temporary abnormal transient conditions, the opening of circuits is also responsible for disagreeable conditions.

So many conditions surround the problem that it is imperative to provide only switching apparatus that is the best and economically sound.

In view of the above remarks, it is only natural that there are many devices available for damping out surge phenomena. Most methods are limited in the visual conception of the requirements in that, while they may serve their individual purpose for the elimination of destructive e.m.f.'s in any individual piece of apparatus, they fail to serve their full duty in preserving the stability and continuity of the service in question. In effect, over-voltages should be discharged from the line, which is exactly what the oscillation limiter performs. Contrary to the static condenser, the arrestor is not continually in circuit, but acts only at the moment of an over-voltage of sufficient magnitude by connecting a damping circuit to the surging line, which dissipates the surge within a fraction of a cycle of the normal line current. Its chief components consist of a damping resistance and an adjustable spark gap, the determination of which is set by the amplitude of the surge, and it may be fitted with an arc-extinguishing device. The whole process requires not more than 1/100 part of a second. It is comparatively inexpensive, and serves to preserve stability of the circuit, protecting the whole line and the apparatus connected thereto. It is important to note the economy that is effected by these means, instead of providing, say, condensers with each transformer.

Switchgear.—It is said that switchgear design is 80 per cent. mechanical and 10 per cent. electrical, but what about its application? The success of any scheme is dependent upon its control, which implies an intimate knowledge of the physical and electrical phenomena attending service.

The fuse provides a very economical and effective short-circuit protection for both service and equipment, and is the most inexpensive device to install. Some are uneconomical owing to their continuous wattage dissipation and failure to provide selective operation. If, however, it is possible to secure the combined advantages of oil-switch operation with selectivity and rapidity, we approach ideal conditions of isolation, and designs are available with automatic tripping devices that meet all the conditions of effective operation. There is a distinct advantage in the opening of all three phases in that synchronous machinery is not thrown out of step, or the circuit rendered unstable. The automatic switch in which the author is interested will open within one-half period of the wave, thereby limiting its rise and effect, reducing its kVA disruptive capacity to a minimum.

Discussion.

Mr. R. Borlase Matthews (chairman), after commenting that the author's offer to give members further information was a very generous one indeed, said that in all branches of engineering and commercial life efficiency had proved to be the ultimate thing, but too often people overlooked efficiency, and it was for that reason that the phrase in the paper with regard to the capitalisation of losses could be regarded as the crux of it. The president, Mr. W. C. Bexon, wished to draw attention to switchgear requirements for a particular purpose, and he had sent the information contained in Table I as throwing some light on this question:

TABLE I.—SWITCH DATA.

Contractor	No. 1.	No. 2.	No. 3.
Rupturing capacity ...	350,000 kVA	350,000 kVA	350,000 kVA
Length of stroke	8½ in.	10 in.	12½ in.
Head of oil above break	2½ in.	16½ in.	14 in.
Opening speed	5 sec.	7 sec.	8 sec.
Closing speed	0.32 sec.	0.25 sec.	0.34 sec.
Thickness of tank ...	¼×¼×¼ in.	1¼×¾×¾ in.	¾×¼×¼ in.
Weight of switch unit	7,840 lb.	10,700 lb.	7,860 lb.
Quantity of oil	78 gal.	70 gal.	155 gal.
Hydraulic pressure on tank	150 lb. per sq. in.	300 lb. per sq. in.	200 lb. per sq. in.

The technical details of an 11,000-volt switch of a rupturing capacity of 250,000 kVA were identically the same as those of No. 1, excepting that the thickness of the tank was reduced to ⅜ in.

Continuing, Mr. Borlase Matthews said that those figures would convince anybody that there was something wrong with ideas relating to efficiency, having regard to the extraordinary differences between what was put forward by three different contractors for switches for identically the same purpose.

Major T. Rich said the remark that, in the case of rural distribution, greater economies could be effected by increasing the number of transformers with a corresponding decrease in size per area of distribution, which improved the load factor, was very important, because there was a tendency to-day to increase the area supplied by a transformer to such an extent that operating troubles, excessive line losses, &c., resulted: that tended to show that the multiplication of transformers when properly done was not such an evil as some people seemed to think. On the Continent, generally, even with 220 volts, they did not have the same size areas, nor did they use such big transformers as were used in this country. The question of using rotary-convertors or auto-synchronous motors instead of changing to a.c. was one of very considerable importance, but it must be remembered that the cost of much of the automatic gear which was fashionable to-day increased the cost of an installation very severely.

Mr. G. F. Gregory said he had two automatic switching stations and another one was being installed. They certainly appeared to be expensive, but, on the basis of capital cost, experience indicated that the position was not so bad as it might appear. Changing over from d.c. to a.c. in many of the smaller areas depended upon how far it was possible to use the old 3-core cables. That might sound like bad practice, but, if those mains were not heavily loaded, it was possible to split up sufficiently the phases and feed the 3-core cables with a.c. Trouble began, however, when there were fairly large domestic consumers, but in some cases it paid to change over under those conditions. In other districts an appalling cost would be entailed in changing over to a.c. entirely; it was a very wide subject and each case must be dealt with on its merits.

Mr. J. P. S. Pillans, remarking that the author was an expert on power-factor problems, said there were the consumer's and the supply authority's points of view. The consumer must either be rewarded for improving his power factor, or penalised for running at a bad one, and he was rather surprised to see it stated in the paper that the cost of power was £3 per kW, in which case the power factor, so far as the consumer was concerned, would not be corrected. In a certain case in which a consumer was running a d.c. factory installation he was recently offered very much better rates to take a.c. The respective costs were carefully analysed, with the result that it was found to be far cheaper, both from the capital and running costs points of view, to keep all the d.c plant and put in an a.c. convertor. That was rather surprising, with rectifiers as cheap as they were; as a matter of fact, rectifiers were the most expensive alternative in that scheme.

Mr. C. E. Sexton said that many engineers now dispensed with fuses for the protection of transformers on the high-voltage side.

Mr. R. Borlase Matthews (chairman), in bringing the discussion to a close, said that as time went on he believed it would be better appreciated that the more work done in the factory and the less done in putting apparatus up on site, the more economical would the result be. It was a factor which came into the capitalised cost, because it meant an addition to the capital cost of the apparatus. Most maintenance gangs had an idea that manufacturers were rather perverse and that if they went out on jobs they would never construct things in the way they did. The excuse of the manufacturer was that people who bought switches did not take into account the shortcomings of their own maintenance staffs, and they had not been willing to pay that little extra to the manufacturer which would result in a reduction of maintenance.

Mr. A. G. Collis, in reply, said it was most extraordinary that it was impossible to get manufacturers to agree as to the size, speed of opening, cubic capacity of the contents of the oil tank, &c., for a given kVA rupturing capacity. He had been to Newcastle for the Research Association and tested some switches, so as to arrive at what might be regarded as the correct interpretation of design. The first test was carried out for 48 hours continuously and the switch operated perfectly. They were so pleased with themselves that they set to work to manufacture; however, they had not got half a dozen on circuit before they all blew up. It was a most extraordinary thing that service conditions varied so considerably that it was impossible to lay down definite rule-of-thumb details, or a definite formula, for a particular size of switch. Therefore, to compensate for that, designers added a factor of from 1.8 to 3 after having made their tests. A large number of manufacturers of oil switches had not the facilities for testing which some of the large companeis had; smaller people copied their competitors, with the results indicated in the figures Mr. Bexon had sent. Actually, the switch which would break most satisfactorily was the second of the three. It was found in one case that by increasing the number of transformers from one to four the load factor of each individual transformer was increased and the transmission losses were reduced. Personally, he had not much love for a.c. low-voltage distribution and Mr. Gregory would confirm his statement that it had been possible to convert h.p. a.c. to l.p. d.c by means of automatic sub-stations much more economically than if he had continued to use transformers; the figure, he believed, was 0.12d. per kWh saving. Power factor was much more important than might be imagined, apart from the cost of power. He had come across very difficult technical troubles due to the power factor causing surges on the line, which meant either the provision of some means for correcting the stability of the circuit, or insisting on consumers having machines which ran approximately at unity power factor at all loads. If the latter were impossible, then it was essential to fall back on a surge limiter for protection against over-voltage. Whatever that limiter was set for it would keep the voltage within that range. It would be difficult to make all consumers maintain unity power factor, on account of the capital cost, unless some financial inducement was offered; he preferred the kVA basis of charging because the mains could be loaded much higher and better revenue obtained. He had merely referred to £3 per kVA and 0.5d. per kWh as tentative figures. Fuses should be used for protecting small transformers, say of 25 kVA and downwards.

Heat Transfer in Boilers.

The often-used law of heat radiation requires modification when dealing with radiation from luminous flames.

IN a memorandum by the chief engineer, Dr. Telford Petrie, of the Manchester Steam Users' Association for 1929, is given an account of an investigation into the measurement of radiant-heat transfer in boilers, showing that the often-used Stefan-Boltzman law of radiation, based on the 4th power of the absolute temperature of a perfect black body, requires modification when dealing with the radiation effects of a luminous flame. The following notes are extracted from the account.

The great advance in recent times in our knowledge of physical phenomena suggests a possible means of approach to a more detailed analysis of radiant-heat effects in boilers. The radiation of heat is now recognised as a phenomenon similar to that of the radiation of light, and, indeed, the difference between the two resolves itself merely into a question of the difference of the wavelengths of the emitted radiation. Radiation of heat from a body, therefore, is not confined to any one wavelength, and is generally a composite effect of emission on several.

If the flame generated in the combustion chamber of a boiler be regarded as a black-body radiator, that is, that it is composed of solid masses of glowing carbon of perfect radiating power, the heat radiated to the walls and heating surfaces can be calculated by means of the Stefan-Boltzmann law, and the area swept by, or exposed to, the action of the flame will be that given by the sides, roof and bottom of the chamber of the type now used in pulverised-fuel installations. It is not correct to make this assumption, however, as by doing so the heat transmission is over-estimated.

The products of the combustion of fuel are composed in the main of a mixture of carbon-dioxide, carbon-monoxide, water vapour, oxygen and nitrogen, the two latter constituents being supplied by the combustion air. The proportion of carbon-monoxide present in the flue gases of a pulverised-fuel-fired boiler is very small and may be neglected. Nitrogen and oxygen are very poor heat radiators, so that we have only to take into account the radiation from the carbon-dioxide and water vapour, both of which radiate strongly. Another important factor, other than the gaseous constitution of the products of combustion, is yet to be considered, since the flame resultant on the combustion of pulverised fuel acquires its luminosity from the presence of the minute particles of glowing carbon suspended in it. It is a well-recognised and demonstrable fact that luminous flames are better heat radiators than non-luminous ones, and this is to be ascribed to the presence of incandescent

particles of carbon. In any consideration, therefore, of the heat-radiating powers of flames, the net result of the investigation should be arrived at by an analysis of the separate factors contributing to the radiation, which divide themselves into two distinct parts, first, the radiation from the heated gases, and second, that from the incandescent carbon or soot giving the luminosity to the flame

Besides being dependent on their absolute temperature, the heat emitted by the gases was also found to be a function of the pressure of the gases (p) and the thickness of the radiating layers (s). From experimental investigations, Dr. Schack has determined for different temperatures the total heat radiation of infinitely thick layers of both carbon-dioxide and water vapour over their three important radiating wave bands. The composite radiation of each gas is then obtainable by multiplication of the appropriate values of these radiations from the several wave bands by functions dependent upon the actual gas pressures and layer thicknesses. In this manner the total radiation from a layer of hot gas, such as that in a boiler furnace in which carbon-dioxide and water vapour are present, can be determined. Dr. Schack states that soot in suspension in a luminous flame has similar properties to those of solid carbon, and therefore it can be treated a solid carbon, except that, when considering the heat-radiating power of a flame, a modification must be introduced on account of the dispersion of the soot as minute particles throughout the flame. The temperature of a flame can be determined by the use of an optical pyrometer, but this temperature, so obtained, is what is known as the "black-body temperature" Ts, and is lower than the true temperature of the flame T by a certain amount ($T-Ts$). The true temperature of the flame could be measured by calibrated thermo-couples or other similar devices. As, however, the luminosity of the flame is due to the suspended glowing soot or carbon in it, the temperature measured by the optical pyrometer is the "brightness temperature" of carbon. The true temperatures of carbon corresponding to given brightness temperatures have been experimentally determined, and the relation between these two temperatures is given in the form of a graph, from which for a measured apparent flame temperature the difference $T-Ts$ can readily be ascertained. The necessary modification for dispersion takes the form of an exponential function involving a factor "ks" termed the "absorption" strength," which factor is dependent upon the temperature difference $T-Ts$. By the use of the "absorption strength" so obtained for a flame of any measured temperature, the capability of the latter for radiating heat as compared with that of the perfect black body may be estimated. This capability is called the "blackness degree" of the flame. The radiation of the perfect black body for a given temperature is obtained by Stefan's law, and by multiplication by the approximate "blackness degree" of the flame the radiation of the flame due to its luminosity alone is given. The total radiation of a luminous flame is, then, the sum of this luminosity radiation and the radiations due to the presence of carbon-dioxide and water vapour as previously found.

The composite heat transmission to the boiler tubes is a complicated and scarcely determinable one. It is reasonable to assume that the semi-circumference of the tube facing the furnace will be subject to the full furnace radiation, and to suppose that, in the main, the water tubes comprising the protective screen of the furnace walls receive the major portion of their heat by radiation from the incandescent gases.

Cable-fault Locating.

The Application of Present-day Apparatus and Methods to Difficult and Peculiar Cases.

At the meeting of the London Technical Group of the Electrical Power Engineers' Association on November 11th a paper was read by Mr. T. W. Corbin on "Fault Locating Methods and Instruments." In the paper the search-coil, bridge, fall-of-potential and capacity-measurement methods of fault location are outlined. In introducing the subject, the author spoke on a number of general matters not touched upon in his paper. Dealing with the Sharman cable-fault detector, he said it had been discovered that that instrument would not work in certain places, and investigations which had been carried out suggested that a damp soil was necessary for the instrument to do its best work.

Very few engneers seemed to realise that the resistance of an earth fault was a very important element in the problem. In one case in which the instrument could not be got to work it was found that insufficient current was being used for the test. He recommended the mains engineer in question to use a hand generator which would give 1,000 volts, and when that was done, in conjunction with a sensitive galvanometer, the results were quite satisfactory. Very often a testing instrument was condemned as useless, when in actual fact the trouble was due to the length of cable being tested having several different diameters. Very often the fault measurement was more accurate on a long length of cable than on a short length, because on a short length of cable a disturbing factor had a much larger proportional effect. In experimenting with a search coil he had had specially designed for tracking the positions of mains, he had obtained some curious results. One was a pulsating effect along the cable, and another was a rattling noise which seemed to have nothing whatever to do with ordinary a.c. He had heard of places where mains wireless sets could not be used because of something of the kind, and it would be very interesting to ascertain the significance of those mysterious sounds.

Discussion.

Mr. J. R. Cowie, chairman, said that on one occasion the search-coil method indicated that a 6,600-V cable was dead when it was not. It seemed to him that the advantage of the Sharman instrument was that a high-frequency was superimposed. The use of a high-frequency coil in testing would probably become more prevalent as the voltage of cables increased.

Mr. A. H. Bennett asked how the author would go to work in the case of a fault on a system working at 11,000, 33,000, or, perhaps, 66,000 volts, with anything from 10,000 to 100,000 kW behind it? Assuming also that the resistance between the ends of the fault where the burn-out occurred was one megohm, and that the resistance of the other two ends to the lead was ¼ megohm, it would be impossible to have a loop, so how would the author find the fault? Referring to the curious results obtained by the author, was the latter quite certain that he heard a 50-cycle note; he should imagine it was a harmonic.

Mr. Drew said that the large-percentage errors in short cables were probably due to the high resistance of the galvanometer.

Mr. Gridley asked the author how he would deal with a fault in a cable running alongside an electrically-operated railway, with the current in the conductor rails constantly varying, so that with every variation there was something induced in the cable which would affect the galvanometer.

The author said he would arrange a bridge so that the battery current escaped at the fault. The circumstances mentioned would surely have the effect of reinforcing or otherwise the battery current, and would not affect the galvanometer. The fault described by Mr. Bennett could be located by means of a capacity test; experience had shown that even 100,000 ohms did not vitiate that test. With regard to the 50-cycle note, he was not so sure about it after hearing what Mr. Bennett had said, and there might be harmonics. In one case he had distinctly heard a note and also its octave, but even that would not account for crackling noises.

Mr. Bennett did not see how it would be possible to apply a capacity test on a fault with a very low resistance across the fault.

The author claimed that his capacity measurer would do it. If a telephone was used instead of a ballistic galvanometer the result would be satisfactory. The two capacities would be balanced, and the silence of the telephone would indicate that a balance had been obtained.

Mr. A. G. Hilling asked how the author would go to work in the case of a fault on a cable supplying, say, 100 consumers, all of whose installations had varying degrees of insulation?

The author saw no other course than to ask the consumers to take out their main switches.

Mr. March said he had used lamps off the live cable for locating high-resistance faults by the bridge method, but had experienced arcing at the tapping key of the apparatus; thus the galvanometer was not in circuit all the time. He had found he could locate high-resistance faults of the order of 10,000 to 15,000 ohms on small cables by connecting up an ordinary megger.

The author said that when he recommended a hand generator he had in mind faults of 100,000 ohms or more. Arcing at the contact was due to too much current and too little resistance; therefore, whilst further lamps would be useful, he still considered the hand generator better.

Mr. J. H. Appleby mentioned the case of a five-core underground cable supplying a rural district, the cable being 1¼ miles long. The fifth core was supplying some 24 street lamps, and a fault developed on it. All methods of testing had failed to locate the fault, and "cut-and-try" was the only thing to do. It was then found there were two faults, possibly 300 yards apart. Could the author suggest a method of testing other than "cut-and-try"? It was a case of a "dead" earth

The author said he knew of no method of testing which would indicate more than one fault at a time, although perhaps the Sharman instrument would differentiate between the two faults. It was often found in testing for faults that the copper conductors had not the same sectional area along the whole of their length. It would be interesting to know from the cable makers whether the resistance of the lead sheath and cores was now sufficiently uniform and reliable to enable measurements to be taken.

Mr. Allen remarked that, with regard to copper, the British Standards Specification allowed a variation of 2 per cent., and that factor should be taken into account. The same variation in thickness was allowed in the case of lead, but there was the further factor to be considered that every cable maker used his own particular lead-alloy. Some used tin, and others zinc, while cadmium and other alloys were also employed each of which effected the resistance per unit length of the lead sheath.

Radio Beam-aerial Arrays.

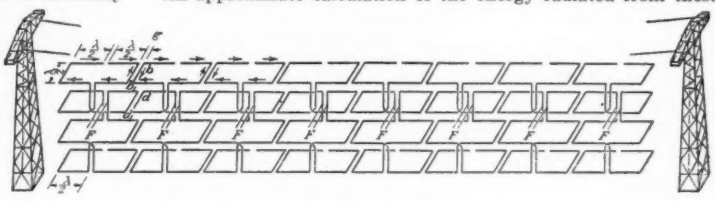
A new type devised by the author, and developed for the British Post Office, for which economic advantages are claimed.

By T. WALMSLEY, B.Sc.

SINCE the establishment of the fact that short-wave beam radio-telegraphy is a highly successful commercial proposition, many different types of beam aerial arrays have been developed. The principle in all is the same; by means of wires correctly spaced, and currents correctly phased, an increase in field strengths in the desired direction and a decrease in other directions are produced.

Which is the desired direction of propagation for distant reception? In the horizontal plane the direction is obviously along the great circle joining the transmitting and receiving stations, but the most favourable direction in the vertical plane is not so easy to decide. However, practical evidence supports the contention that, although the direction is not critical, the best angle of projection is a few degrees from the horizontal. Recently the British Post Office Engineering Department and the American Telephone and Telegraph Co. conducted tests between the U.S.A. and England upon the received field strength in England due to two or three half-wave high arrays of the Sterba type. The results showed that the improvement of these arrays over a single half-wave vertical aerial is such as might be expected on the assumptions that the earth is a perfect conductor and that the desired direction is horizontal, or almost so. Again, experiments between Germany and America on 15 and 20 metres have shown that the best angle of projection is zero, *i.e.*, the most favourable radiation is approximately parallel to the surface of the earth.

Consideration of the relative gains obtainable by the use of various combinations of half-wave radiators, economical sizes of aerial arrays and site areas, heights and weights of masts, and their respective costs, led the author, on behalf of the Post Office Engineering Department, to devise and build arrays consisting of a number of units of the "T.W." types shown in figs. 1 and 2, from which the reflector curtain has been omitted for the sake of clearness. The units may be used in groups, either of vertical radiators or (by rotating the whole system through 90 deg.) of horizontal radiators. Each unit is "current-fed," *i.e.*, the attachment to the transmission lines is made at the centre of a half-wave element at the position of minimum impedance. The phase of the current in the various half-wave sections is shown conventionally by arrows; thus in fig. 1 all the lines of radiators *ab*, *cd*, *ef*, *gh*, have currents in phase with each other, whilst all the lines a_1b_1, c_1d_1, e_1f_1, g_1h_1, have also currents in phase with each other, but 180 deg. out of phase with those in the first lines. Antinodes of current and nodes of potential occur at the middle of each half-wave radiator. The side radiation from the elements aa_1, bb_1, cc_1, dd_1, might at first sight be thought to be considerable. However, the spacing of these elements and the phasing of their currents are such as to produce a comparatively small amount of side-radiated energy. An approximate calculation of the energy radiated from these members shows that the resulting loss per unit is about 16 per cent. of the total energy supplied to each. With the horizontal type of array (fig. 2), in which several units are used, the wires bb_1, dd_1, &c., of each unit are in close proximity to similar wires of the adjacent unit, except at the two ends of the array. The currents in these adjacent wires are 180 deg. out of phase, and thus side radiation is almost entirely cancelled. In the case of the assembly of vertical units, such mutual cancellation is not experienced.

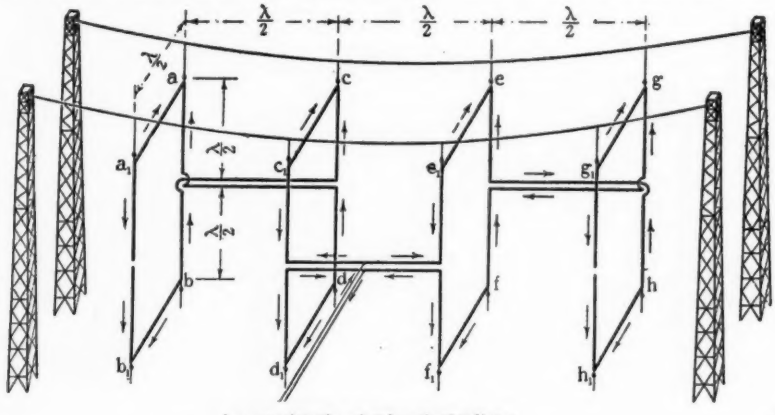


F = feeding points.

Fig. 2.—Horizontal Array.

Unwanted radiation cancellation can to a large extent be obtained, however, by means of wires (insulated at their ends and approximately half a wave-length long) stretched parallel to the offending elements. When the space separation between wires is 1/16 (0.0625) of a wave-length, the phase separation between the currents in the two wires is 170 deg., and the currents have approximately equal amplitudes. Under these conditions the energy radiated from the dual combination is calculated to be about 17 per cent. of the energy radiated from the single radiator.

Tests made for the author by Mr. A. H. Mumford confirmed qualitatively the fact that radiation from an excited wire can be greatly reduced by means of currents induced



λ = wavelength = 2 × length of radiator.

Fig. 1.—Vertical Array, Single Unit.

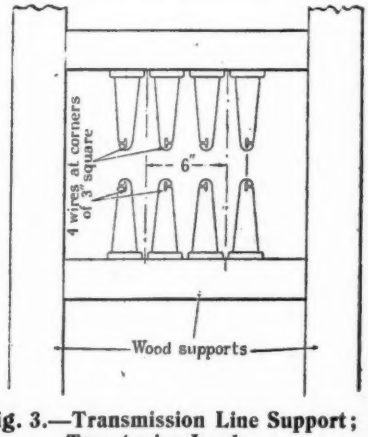


Fig. 3.—Transmission Line Support; Two 4-wire Leads.

in a parallel wire. Tests with a "T.W." vertical array were also made to ascertain the effect on the efficiency of the array of insulated wires a little less than half a wavelength long. It was found that the ratio of field strength, measured several wavelengths away, to array input improved appreciably when the suppression wires were used.

Open transmission lines feed both types of "T.W." array. Well-known principles of matching correctly the termination and junctions of transmission lines have been tried and tests made with combinations of coils and condensers; however, as they are difficult to adjust and, unless well protected, variable in behaviour under different climatic conditions, a more practical solution is offered by designing transmission and feeding lines to have correct surge impedances. The multi-wire line described in a later part of the paper lends itself admirably to this purpose, as variations in surge impedances from 150 to 600 ohms can readily be obtained. When standing waves occur along a transmission line maximum and minimum peaks of voltage are produced at distances separated by multiples of a quarter of a wavelength; also the surge impedance of the line is the geometric mean of the apparent impedances at the points of adjacent quarter-wave peaks. By applying these principles and choosing the best positions for the junctions of feeders and transmission lines reflections can be greatly reduced.

Two practical difficulties encountered in fixing suitable matching devices to some types of array are due, first, to the height above the ground of the feed position and, secondly, to the wide difference between the impedances of the array and the feed line. Owing to the series arrangement of radiators this disadvantage is not shared by either the Sterba or the "T.W." array, which, when correctly adjusted, have an impedance approximately equal to that of the open two-wire transmission lines.

Comparison between a half-wave vertical receiving aerial and a "T.W." 16-metre vertical-type array consisting of four units, *i.e.*, having a span between extreme wires equal to 7½ wavelengths, disclosed a gain of 20 decibels; allowing 3 decibels for the reflector, the maximum theoretical gain was 19.4 decibels.

Considerable attention has been given recently to arrays consisting of groups of horizontal radiators. In Germany and Holland particularly this type has gained favour, and the behaviour of a "T.W." horizontal type of array consisting of eight units is therefore of interest, for it shows that the theoretical expectation for this type of array can be realised.

Scarcely less important than suitable types of array is the problem of suitable transmission lines. The contention is frequently made that, owing to their low energy losses at radio frequencies, concentric metallic-tube transmission lines are economically essential. The Marconi beam telegraph stations in England and abroad, the French St. Assise station, and the German Nauen station all use concentric tube lines. For reception purposes the "pick-up" with open transmission lines is considered by many radio engineers to be so serious as to prevent their use, even on short lines. The author of the present paper contests this view by showing how losses on open transmission lines may be reduced to such an extent as to render them successful competitors to concentric tube lines. Formulæ are obtained to enable the losses in transmission lines to be determined, and by applying them the losses in several open lines, connected to various types of array, are calculated. An analysis of the losses is then made, and as a result the opinion is advanced that the type of array used influences the amount of losses. A special type of multi-wire line is finally described. It consists of four 200-lb.-per-mile copper wires, built 2½ ft. from the ground (fig. 3), the wires of each limb being insulated from each other but joined together at their extremities. When connected to a type of array that gave rise to unbalanced currents, the efficiency of the line was 71 per cent. on a wavelength of 20.8 metres. The calculated ohmic loss is 16 per cent., leaving 13 per cent. for radiation and other losses. The ohmic resistance could, of course, be reduced to a low value by increasing the number of wires. As the comparative cost of a concentric tube line and a multi-wire line is 5 : 1, approximately, a multi-wire line forms an economical substitute for a tube line. It has the additional advantage of simplifying the connections to arrays. For example, pairs of wires of a 2-4-wire line can be selected to connect to each of the units of a 4-unit array. The spacing of the grouped wires can be readily adjusted, so that at the position where the various pairs branch off to the array correct impedance values are obtained. Such an arrangement has advantages over the usual divided feed, inasmuch as it eliminates several junctions and thus reduces the number of impedance matching connections. The necessity for matching impedances correctly arises more on account of the reduction in power delivered to the aerials than from the resulting losses in lines, if this precaution is not taken. To summarise, the conclusion has been reached that losses in open transmission lines are caused by (1) unbalanced currents in the line wires, (2) ohmic high-frequency resistance, (3) space separation of the wires, (4) dielectric losses in insulators, (5) reflections from points where the line constants change.

Methods have been suggested whereby the losses can be reduced and it has been shown that, contrary to the usually accepted belief, open transmission lines (particularly those used in conjunction with symmetrical types of aerial systems) may have low electrical losses.

The thanks of the author are due to the Engineer-in-Chief of the British Post Office for permission to publish this paper.

Electric Traction.

The More Important Factors to be Taken into Account in Railway Electrification.

By LIEUT.-COL. E. O'BRIEN, D.S.O., M.I.E.E.

(Summary of lecture delivered to the LONDON STUDENTS' SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.*)*

THE lecturer commenced by drawing the attention of his audience to the wealth of information now available for young engineers in connection with such a subject as electric traction, as compared with 20 years ago, and expressed the opinion that more openings than ever were available for the manufacture and sale of British goods in the traction field, not only in the sphere of heavy traction, which was bound to be somewhat limited, but in the much wider field covered by runways, industrial locomotives, accumulator vehicles, &c.

The importance of reducing the capital expenditure on the provision of transport and the relation of the density of traffic to the capital expenditure were emphasised.

The other expenses in connection with transport on energy, heavy repairs, light repairs and inspection, running charges and personnel, were then examined, and the importance of designing all plant to run for long periods with a minimum of inspection was discussed.

The great importance of statistical analysis of all faults for the purpose of eliminating the causes of these faults and either rendering apparatus fault free or improving future design was pointed out, and the opinion expressed that with a constant amount of plant in service a well-managed undertaking should show a steady diminution in repair costs per unit of work done and a constant lessening of the numbers of the staff employed on inspection and repairs.

Dealing more particularly with railway work, the design of the armature of the railway motor and the robustness of the control gear deserved special attention. The armatures of traction motors were subjected to extraordinarily severe stresses, and faults were liable to react through the whole supply system, though the provision of high-speed circuit breakers had greatly limited the possibilities of damage.

The history of electric traction on railways was briefly traced, and it was shown that development had been very gradual and that the increase in size of motors and the use of higher voltages had slowly come about with improved design.

The advantages and economies to be obtained from electric traction on suburban lines were mainly due to the limitations of the steam locomotive in weight and power. The great importance of reducing the weight of suburban rolling stock to a minimum was also dealt with.

Main-line electrification had developed concurrently with suburban electrification, but mainly to meet specially severe conditions of traffic due to grades and tunnels. The main factors determining the probable success of a main-line electrification were (1) density of traffic, and (2) ratio between the cost of coal and electrical energy.

It was pointed out that as the electrical equipment of main-line trains was accelerated and retarded only once every 10 to 15 miles, as against once every mile for suburban trains, and as most of the wear and tear arose from acceleration and deceleration forces, the repairs to main-line locomotives or motor cars was likely to be substantially less than for suburban services.

The relative merits and the existing fields of use of direct current, single-phase, and three-phase, were briefly compared.

The lecturer then showed a number of lantern slides illustrating the many types of design that had been developed for main-line electric locomotives.

It was pointed out that main lines most suited to electrification usually had a very large mileage of sidings, the problem of dealing with which was not yet completely solved, but it seemed probable that the solution lay in the use of the Diesel

electric locomotive carrying accumulators to afford a reserve of power for starting purposes.

In conclusion, the lecturer referred briefly to the possibility of higher speeds on railways whose physical configuration in the shape of curves and stations did not limit the speed. It was pointed out that much higher speeds would be obtained without increase of energy consumed by the use of suitably shaped ends to the locomotive and by making the surface of the train perfectly smooth.

Such shaping of the ends of the locomotive was impossible with the steam locomotive.

There was no discussion in the ordinary sense, but, Lt.-Col. O'Brien having kindly offered to answer questions, a number of speakers raised points relating to both electrical and mechanical problems. Some of them related to the use of ball or roller bearings, in place of plain bearings, and of different types of flexible drive. One speaker criticised the use of link-rod drive as involving a change from rotary to reciprocating motion and back to rotary again. Col. O'Brien pointed out the economic advantages of the arrangement under certain conditions, although he admitted its technical absurdity.

Regenerative braking was the subject of several questions; and it was asked what would happen in the event of the circuit-breakers coming out during a period of violent braking Col. O'Brien said that in such a case it would be necessary to rely on the friction brakes until the breaker was replaced. He pointed out that for regenerative braking to be of any use there must be other trains on the line to absorb the power.

The following members took part: Messrs. JERVIS SMITH, SQUIRE, HOLMES, KERR, MERRICK, GARSIDE, MARTIN, HERWALD, and HARRIS.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Battery Inspection Lamp.

The accompanying illustration, fig. 1, shows the "Hart" battery inspection lamp recently introduced by the HART ACCUMULATOR CO., LTD., Stratford, E.15, to enable the interiors of storage batteries to be easily and readily examined. The lamp proper provides a brilliant light and is assembled in a strong glass tube which can be safely immersed in the acid without any harm occurring. In the larger sizes of batteries the tube can be passed between the plates of the cells,

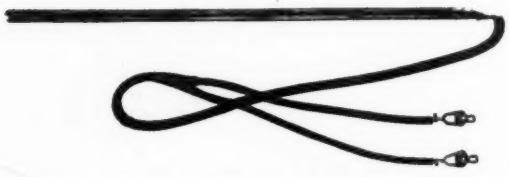


Fig. 1.—"Hart" Battery Inspection Lamp.

and it is, therefore, a great assistance when the cells are undergoing their periodical inspection by the battery attendant. The lamp is equally suitable for use in cases where it is required to illuminate narrow, confined spaces in general commercial requirements, such as for boiler inspections, &c. No wiring is wanted, as the lamp is used by temporarily clipping the end connections to the terminals of two 2-volt cells (4 volts). The standard length of the glass tube is 18 in., but other lengths are available, according to requirements.

A New Current Transformer.

The accompanying illustration, fig. 2, shows a new current transformer produced by MESSRS. OSWALD RECORD & CO., 17, Victoria Street, S.W.1, for working pressures up to 6 kV (test pressure 26 kV) and currents up to 600 A. It is made in two sizes: model LF 3a (15 VA class C and 60 VA class D); and model LF 3b (16 VA class 3 and 45 VA class C). The free insulator height is 75 mm. Each apparatus will stand without injury, it is claimed, 90 times its normal rated current for 1 second, or 50 times for 3 seconds. There is a solid one-piece porcelain wall between the primary and secondary windings, and the secondary winding is closely embraced by the primary winding, resulting in a high degree of accuracy. No oil or compound is employed.

An Electrical Test Trolley.

MR. J. A. RYLEY, 3, Newmarket Street, Birmingham, has recently brought out a handy workshop appliance intended for electrical testing of all kinds as applied to cars and commercial vehicles. Clear marking of the terminals and the card of instructions permit unskilled operators to conduct the tests. The whole unit is self-contained and can be mounted on a trolley, so that it can be taken to any car in the garage or repair shop. Alternatively, it can be mounted on a bracket as a fixture in the department dealing with electrical equipment. The outfit is provided with long leads to reach any fittings on a car, and a battery carried on the trolley allows the mechanic to ignore the car battery and use one he knows to be in correct condition. The set suits 6 or 12 volts, having cut-outs for both pressures fitted on the panel, with all necessary terminals and change-over switches.

A New Strip-lighting System.

A new system of flexible strip lighting known as "Lumiflex" has been recently introduced in this country by the DOMINION ELECTRICAL CO., 6, Hanway Place, Oxford Street, W.1. It consists essentially of links of bakelite in which are encased the conductors in the form of tinned copper strip, the ends being suitably slotted for interlinking, and looped for receiving Edison screw strip-lighting lamps at 3-in. centres Two-way links, blank ends, plugs, &c., complete the system It is claimed to be watertight, and it should be particularly suitable for concealed lighting, sign work, &c.

A Horseshoe Standard and Bracket.

What is put forward as an ideal Christmas gift by Messrs. L. G. HAWKINS & CO., LTD., 30/35, Drury Lane, W.C.2, is

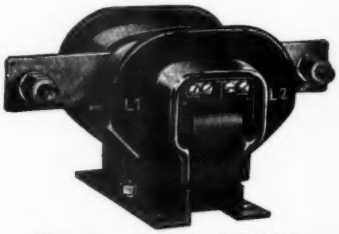


Fig. 2.—"Record" H.Y. Current Transformer.

Fig. 3.—A Seasonable Gift.

the "Lucky Horseshoe" adjustable table lamp and wall bracket depicted in fig. 3. By virtue of the hinge immediately under the candle-fitting cup, the appliance can be used either as shown as a wall bracket, or in an upright position as a table standard, the horseshoe forming the base of the standard. The metal-work is hand wrought by English blacksmiths, and the base consists of an old horseshoe in armour-bright finish. The overall height (in upright position) is 22 in.

Parliamentary News.

[By our Special Parliamentary Reporter.]

The Telephone Service.

On November 25th, MAJOR NATHAN asked the Postmaster-General whether the Government was prepared to hand over the administration of the telephone and telegraph services to a public corporation independent of political control.

MR. LEES-SMITH said that the reply was in the negative.

House-Service Meters.

On November 25th, Major COLVILLE asked the President of the Board of Trade if he would state how the quantity and value of electrical house-service meters imported during the first 10 months of this year compared with the amount imported in the corresponding periods of the years 1928 and 1929.

MR. W. GRAHAM said that the imports of electrical house-service meters and parts thereof into this country during the first ten months of 1930 showed some increase over the imports during the corresponding periods of 1929 and 1928. The following table showed the total imports of complete electrical house-service meters and parts thereof into Great Britain and Northern Ireland registered during the first ten months of 1928, 1929, and 1930:—

	Complete.		Parts.
Period.	Quantity.	Declared value.	Declared value.
January to October.	No.	£	£
1928 ...	83,375	90,505	56,779
1929 ...	93,129	97,866	43,882
1930 ...	93,209	108,648	58,849

Telephony on Moving Trains.

On November 25th, MR. DAY asked the Postmaster-General whether he could state the results of the experiments that had been conducted in this country for the purpose of establishing telephonic communication with moving trains; and if it was proposed to establish an experimental service on any of the main lines in the near future.

MR. LEES-SMITH said that experiments had shown that telephonic communication with moving trains was practicable; but at present the demand for such communication did not seem likely to be sufficient to justify the expense involved to the railway companies in the provision of facilities.

The Receipts of the B.B.C.

On November 27th, MR. LEES-SMITH informed Sir W. Mitchell-Thomson that the total receipts from wireless receiving licences during the year ended March 31st, 1930, and their distribution, were as follows:—Total receipts, £1,537,377; deduct 12½ per cent. (for Post Office expenses of management), £192,172 and contribution to cost of conversion of "spark" stations, &c., £6,686; net receipts, £1,338,519. Of this, £963,171 was paid to the B.B.C. (based on licence receipts for previous year) and the balance of £375,348 accrued to the Exchequer. The corresponding figures for the financial year ending March 31st, 1931, were estimated to be as follows:—Total receipts, £1,725,000; deduct 12½ per cent. for Post Office, £215,625, and cost of conversion of "spark" stations, &c., £3,150; leaving net receipts of £1,506,225. Of this, £1,069,648 would be payable to the B.C.C., and the balance accruing to the Exchequer, £436,577. He was not in a position to furnish particulars of the total income of the British Broadcasting Corporation from all sources during the same two periods, but its total income during the year ended December 31st, 1929, was shown in its third annual report as £1,097,337.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

British Motor Prices.

Mr. Allam has failed to consider the point that the ultimate fixer of prices is the consumer, not the manufacturer. It would be well enough for British makers to agree to raise their prices if British motors were the only ones available; but unfortunately it is not possible to persuade foreign makers to do the same thing. Mr. Allam knows very well how severe foreign competition is, and he no doubt knows also that very many buyers will accept Continental motors of such poor design and quality that any British manufacturer would be laughed at if he offered a motor of the same quality, even at the same price.

No doubt the value of a motor to its user, in terms of service rendered, is greater than its cost, but how can such values be estimated? There is only one policy for British motor makers—to design the best possible motor, having regard only to engineering considerations and to the convenience of the user, and to base the price on works cost, plus a reasonable profit, plus fixed trade discounts, and to refuse to sell at less than that fixed price for any reason whatever. We have always followed this policy, and we are quite a long way from bankruptcy.

On the other hand, we do undoubtedly lose a percentage of orders to foreign manufacturers simply on price, it not being denied in most cases that our motors are better made. If our prices, along with those of other British makers, were raised to a level even remotely comparable with those of other forms of power plant, the Bankruptcy Court would not be large enough to hold the motor manufacturers who would be seeking admittance, while the country would be flooded with foreign machines.

Normand Electrical Co., Ltd.,
R. E. A. MALLETT, *Director.*

London, S.W.4, *November 28th*, 1930.

The Indian Trade Situation.

I read with interest the advice you gave in your issue of November 7th to those desirous of trading in India, as I spent the whole of last winter on a tour of investigation throughout that country, afterwards going on to Burma and Ceylon, an interesting experience for anyone, but exceptionally so in my case, because throughout my tour a great deal of information was placed at my disposal by the electricity supply undertakings (European and Indian), wiring contractors, and also by consumers of electricity, from the Hindu with his 5-h.p. motor driving a small flour mill, at the back of which he sleeps and has his frugal meals, to the cheery Scot in charge of a large jute mill taking 1,000 h.p. or more from the mains. The whole of the information, collected over several months, enabled me to form an electrical picture of India as fruitful soil for cultivation by the enterprising electrical manufacturer, but he must be efficiently represented and carry stocks in India, as you advise.

Most of our leading manufacturers of heavy electrical plant and cables have their own organisations throughout India, and do an immense amount of business. There are, however, many others who do not appreciate the possibilities of the country, and appoint an agent, more or less as a matter of form, and judge the Indian market on the result. Many excellent firms of agents are to be found in India who have adequate expert staffs and give good service, but there are others who take on any number of agencies of every sort and kind; needless to say, such firms are merely "order-takers." My advice to firms who employ agents who do not send them orders is to go out and see those people and find out the reason. A group of such firms manufacturing non-competitive lines could, for a reasonable sum, send out a man for a cold weather tour, who would not only see as I did the possibilities of the country, but would also ask the agents for an account of their stewardship, and get some idea as to their suitability for the work. The result of his report would probably be the sending out of a resident representative of the group to supervise agents and stocks. He should be given full power to act, as often the delay caused by having to refer matters home may lose an order.

Domestic refrigerators, a luxury at home, are a necessity in India, and are being sold in increasing numbers all over the country, although it is only during the last few years that they have caught on with Europeans and Indians alike. Throughout my travels I looked in vain for a British-made domestic refrigerator; there were any number of foreign make, but not one from home. The Indian's powers of imitation and assimilation are great; he has got the electrical idea, and to supply his needs small electricity undertakings are being licensed all over the country, many of them financed locally.

No political agitation will, I consider, cause more than a temporary check to the flow of business that must follow this rapid spread of the supply and use of electricity throughout India, Burma, and Ceylon.

R. L. Acland.

Ealing, W.13, *November 24th.*

Assisted Wiring Schemes.

With reference to the correspondence regarding assisted wiring, ELECTRICAL REVIEW, October 31st, Wolverhampton has been running a scheme since June; the two-thousandth consumer is being connected this week, and new connections are being made at the rate of 150 per week.

The success of the scheme in the rural districts is very marked, and the following letter received this morning bears out this statement:

"The penny-in-the-slot electricity is denuding ——— of all coppers. When the meters are emptied could the coppers be re-distributed amongst the tradesmen? If the collector put them in 5s. bags it would be quite easy. We only have the bank open for a few hours twice a week."

The name of the town and the writer obviously have to be suppressed.

T. A. G. Margary.

Wolverhampton, *November 25th*, 1930.

The Two-part Tariff.

I am glad that my article has brought one of the Committee into the open and that he has been compelled to descend to certain of the more questionable methods of debate associated with the attorney who has a weak case. Mr. F. W. Purse refers to the relatively small number of undertakings using a rateable value basis for their fixed charge, but I can hardly believe that a *member* of the Committee on Tariffs is unaware of the fact that the 100 undertakings referred to include practically all those of the large cities, headed by Manchester, Liverpool, Glasgow, Sheffield, and Leeds. Unless, therefore, his reference to the *number* of undertakings was intended to be misleading it may perhaps be taken as a side light on the way in which the Committee arrived at its findings.

Mr. Purse also adopts the well-known method of removing phrases from their context. I did *not* state that "the size of house will have no direct effect" upon the fixed charge in a two-part tariff. I said it had no direct effect on *load factor*. Differences in load factor make it necessary to depart from a flat rate and to make some assessment of peak responsibility, which will obviously vary with size of house.

I certainly plead guilty to using the term "equity" in two senses, but, as the two uses were deliberately contrasted in the article and it was suggested that mathematical equity was not real equity, I do not think any apology is necessary.

Why does Mr. Purse refer to the "block," or "step," tariff with a fixed charge as *my* tariff and suggest that it is something new? That tariff is already used by a number of undertakings, including those of such cities as Bradford and Sunderland, although, owing, I presume, to the infrequency of the all-electric house, they are usually content with two steps only. If, as Mr. Purse states, that tariff was not the one turned down by the Committee in less than five lines, it surely follows that it was turned down without any lines at all. My sympathy goes out all the more, therefore, to Mr. T. Roles and Mr. A. S. Blackman, who can, however, find some comfort in the fact that Mr. Purse's letter contains no word of criticism of their tariffs, or defence of that put forward by the Committee.

I agree with Mr. Purse that the present multiplicity of tariffs is unfortunate, but that is no reason for standardising one of the worst. The plain two-part tariff must overcharge either the long-hour or the short-hour consumer and, as the latter is a long-hour consumer in embryo, such a tariff must inevitably discourage progress.

G. L. Porter.

Hollinwood, *November 28th*, 1930.

The Steam Cycle.

With reference to the paper entitled "Some Considerations Affecting the future Development of the Steam Cycle," extracts of which appeared in your journal on November 14th, there is no doubt that the information and curves which Mr. Baumann has published give a very clear and comprehensive view of the problems under discussion, especially with regard to the section dealing with economic feed temperatures.

In order to enable true comparisons to be made the author has allocated a certain definite proportion of the waste heat for air-heating, and another definite portion of the waste heat for water-heating, and this considerably clears the ground for his subsequent calculations. It will be noticed, however, that he has based the cost of the economiser on 10s. per sq. ft. of heating surface. Of this 10s. the actual cost of the economiser itself, including its own casing, soot blowers, &c., amounts to only 7s. per sq. ft. and, therefore, the author has presumably added 3s. per sq. ft. to include connection piping to the boiler flue work at the inlet and outlet of the economiser, share of the cost of building, &c. This 3s. per sq. ft. might be a reasonable addition if it were not for the fact that the type of economiser installed for these plants would require 3 sq. ft. of heating surface for each foot run of tube, or six times the heating surface of the plain tube.

This, in effect, means that the economiser would occupy very much less space than the plain tube economiser, and, therefore, if the author had in mind 3s. per sq. ft. of heating surface for the incidental capital outlay in connection with a plain tube economiser, he would probably be quite in order if he added 1s. per sq. ft. Under these circumstances the total cost to be allowed for the economiser portion would be in the region of 8s. per sq. ft. instead of 10s., and this would, of course, slightly affect the curves in his figs. 23 and 24, though probably not to any very great extent.

It might be argued by the author from this that he would thereby be enabled to increase still further his feed temperature by means of bleeding the turbine, but against this it may be stated that, possibly owing to draught considerations, the heat transmission coefficient in the larger economiser might have to be slightly reduced; this would mean an increase in heating surface, and, therefore, probably the total increase in cost per kW would be somewhere near the value indicated in the figures referred to.

I notice that the author has based his curves on a constant heat transmission coefficient, but, as most steam engineers are now aware, this coefficient varies considerably with different gas velocities, all depending upon the draught available; in fact, the problem is so closely associated with the question of draught and velocity that this subject might be worthy of a section to itself alone.

There is one aspect of the problem which the author appears to have overlooked, and that is with regard to the question of complication of plant. He states that a decrease in the feed temperature of 10 deg. F. is equivalent to 1/50 per cent. in net gain and that a reduction of 22 deg. F. in the feed temperature is equivalent to 1/10 per cent. loss in efficiency. He then plots a curve midway between these two values in order to arrive at a reasonable feed inlet temperature to the economiser. It is a moot point whether a little extra simplicity in the plant, *i.e.*, the cutting out of one or two stages in the feed heating, would not be worth, say, half to one per cent. in efficiency instead of the almost infinitesimal gain mentioned by the author.

According to the 1930 report of the Electricity Commissioners, the most economical station for the last six months shows an overall efficiency of 23.36 per cent., and it is interesting to note in connection with this plant that the feed water enters the economisers at a temperature of 196 deg. F., the gases leaving the economisers and entering the air heaters at a temperature of 320 deg. F.

Lux.

November 30th, 1930.

The Drumm Battery.

Hard upon the heels of my last letter came very momentous news about this battery.

On November 26th the Minister for Industry and Commerce asked the Dail to grant him immediately a sum of £25,000 with which to pursue the commercial development of the Drumm battery. That would bring the amount provided during the current financial year to £30,300, but the Minister warned the House that he foresaw later commitments, which would increase the total grant on this account to about £50,000. With £3,900 advanced from the Contingency Fund, the researches and rail tests appear to have cost no more than £10,000. About £6,000 will be needed until the end of this financial year to satisfy the Railway Company for work already carried out, or about to be put in hand, and for certain other expenses. That leaves about £15,000 for salaries, fees, office expenses, and for the construction of new batteries, and for railway and road tests.

Nothing further was said about road tests, and it is to be inferred from other passages in the Minister's speech that all effort is to be concentrated for the present upon the application of the invention to railway traction. The railway tests are to be full-scale suburban services carried out by two multiple-coach trains, which have been designed by the engineers of the Great Southern Railway Co., and will be made at its Inchicore works.

It is to be presumed that the Minister has come to some arrangement favourable to the State with respect to the incidence of the cost of these trains, which will become part of the rolling stock of the railway company. In this way a large capital sum has been saved to the State.

This grant of £25,000 is, and all other grants are, to be repayable "at such times and on such terms and conditions as the Minister of Finance, after consultation with the Minister for Industry and Commerce, may determine"; in other words, the money will return to the Exchequer whenever the battery pays its way, and not otherwise.

The Dail has, in fact, consented to back a horse in a race in which there are only two runners, Success and Failure, but it is doing so only after getting a straight tip from the trainer of the favourite.

A Minister is bound, in such matters, to take entire responsibility for the statements he makes to build up the case for his proposition, and no one can deny that it is a very serious responsibility. No Minister of State who has any regard for his political reputation, or who does not welcome the abrupt termination of his political career, can afford to give assurances in respect of matters which are entirely outside his personal experience unless they are founded upon, and do not go outside, the advice given to him by the experts to whom he has access, or whose services he can retain for the purpose.

In the case before us Mr. McGilligan has lengthened the odds against Failure until they stand at a very big figure, by calling in the expert assistance of the best people he could find in their respective spheres. He went no further than Dublin for independent legal advice, but he found his electrochemist and his patent-law expert in London. Of those three we have been told the name of one only—Prof. Allman, of London University, but there is not the least reason to suppose that the others are not as notable in their own lines.

Prof. Allman came over last January and was so much impressed by what he saw that, we are told, he agreed with the claims made by Dr. Drumm as to the extreme novelty

of the invention, and as to its being a practical proposition. Prof. Allman's final report is said to be of a very technical nature, and it gives every hope that the invention can be developed successfully.

In the meantime a special Traction Committee was appointed to advise upon the practical side of the invention. The Committee consisted of Mr. Morton, chief engineer of the Great Southern Railway of Ireland; Mr. Monaghan, engineer to the Post Office and past chairman of the Irish Centre, I.E.E.; and Mr. Fay, a member of the Irish Free State Electricity Supply Board.

Laboratory tests were being undertaken all the time by the inventor.

Then came the large-scale trials already reported in the ELECTRICAL REVIEW, and some four or five months ago bench life-tests were begun. Those tests consist in charge-discharge cycles under strenuous conditions for 20 hours out of every 24 hours, and it is upon these uncompleted tests that the Minister felt justified in saying that "to-day we have progressed to a point that enables us to declare with absolute confidence, if not with absolute certainty, that we will get a very long life out of the cells. With that answer in our favour we will have something in the way of battery development which no other country has yet been able to achieve."

It is intended to proceed at once with the manufacture of two trains for suburban service. Each train will be composed of two closely-coupled standard corridor coaches, each coach seating 80 persons. The pair of coaches will be mounted on a centre bogie common to both, and a bogie at each outer end. The centre bogie will be the driving unit, carrying two 200-h.p. motors. The 440-volt battery will be divided between the two coaches, and the whole train, all-in, including 160 passengers, will weigh about 75 tons.

The trains will be designed to accelerate at 1 m.p.h. per sec., and will maintain, for 17 hours daily, a half-hour service with ten minutes standing time each trip for charging. It is believed that the engineers of the railway company have estimated a considerable saving over the present steam service on the Dublin-Bray-Greystones route.

It is not my intention to carry politics into an electrical journal, so that I cannot attempt to deal with the debate which arose out of the motion for this £25,000 grant, and I should advise others who know little, or nothing, about Irish politics to keep their minds fixed upon the salient fact that the Drumm battery has reached now the stage at which it will be determined once and for all whether the battery merits the claims which have been made for it, and the flood-light to which it has been subjected from every quarter of the globe.

Robert N. Tweedy.

Carrickmines, I.F.S., *November 28th*, 1930.

(Several letters have been held over due to pressure on our space.—EDS., ELEC. REV.)

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

13,285. "Potential divider, in particular for radio receiving apparatus." L. Koros. October 12th, 1928 (337,793.)

13,417. "Electric totalising and indicating systems." British Thomson-Houston Co., Ltd., and A. J. Johnston. April 30th, 1929. (337,775.)

14,246. "Optical indicating means associated with a relay device for use with measuring instruments." Siemens & Halske Akt. Ges. March 2nd, 1929. (Patent of addition not granted.) (337,776.)

16,171. "Electric vacuum tubes." Arturus Radio Tube Co. June 5th, 1928. (313,046.)

20,156. "Means for protecting the insulating sleeves of electrical machine windings from glow-discharge phenomena." Siemens-Schuckertwerke Akt. Ges. July 2nd, 1928. (314,808.)

20,226. "Electric gramophone pick-ups." P. D. Tyers. July 2nd, 1929. (337,780.)

20,467. "Electric cables." Felten & Guilleaume Carlswerk Akt. Ges. July 3rd, 1928. (314,882.)

20,547. "Electric lamps and the like." British Thomson-Houston Co., Ltd. February 18th, 1929. (337,782.)

20,699. "Means for synchronising transmitters and receivers in picture and the like telegraph systems." S. B. Smith. July 5th, 1929. (337,743.)

23,331. "Electrical transmission and reception of pictures or other representations." O. Fulton and H. A. Chaplin. July 30th, 1929. (337,769.)

23,385. "Electrical methods of, and means for, detecting, measuring, and recording changes in physical conditions or properties of materials and the like." J. J. Dowling and K. S. G. Sommerville. July 30th, 1929. (337,785.)

23,703. "Electrical insulators." Hermsdorf-Schomburg-Isolatoren Ges. December 5th, 1928. (Addition to 289,709.) (337,748.)

23,750. "Electric selective control apparatus." Automatic Musical Instrument Co. August 6th, 1928. (316,941.)

23,792. "Device for lubricating the sliding bows or current collectors of electric vehicles." J. F. D. Tovaros. August 2nd, 1929. (337,804.)

23,820. "Apparatus for the electric distant control of adjustable devices situated in sub-stations from a main station." Siemens & Halske Akt. Ges. August 9th, 1928. (317,050.)

24,174. "Wireless receiving apparatus." J. L. Routin. August 7th, 1928. (316,985.)

24,215. "Construction of gas and electric fires." A. Bell & Co., Ltd., and N. M. Bell. August 8th, 1929. (337,816.)

24,424. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Flenley. August 9th, 1929. (337,829.)

24,442. "Electrical amplifier circuits." Radio Frequency Laboratories, Inc. June 8th, 1929. (337,830.)

24,910. "Electric switches." W. W. Triggs (Hart Manufacturing Co.). August 15th, 1929. (337,851.)

25,028. "Loud speakers." H. Branton-Williams, H. G. Bawtree, E. A. Bitton, and H. Austin Storry, Ltd. August 16th, 1929. (337,853.)

25,242. "Wireless apparatus." A. A. Price. August 19th, 1929. (337,858.)

25,303. "Electric braking." W. A. Stevens. August 20th, 1929. (Cognate applications, 25,667/29, 27,328/29, and 14,113/30.) (337,859.)

25,502. "Maximum-demand indicators for electric circuits." G. Wall. August 21st, 1929. (337,863.)

25,590. "Electric condensers." British Thomson-Houston Co., Ltd. (General Electric Co.). August 22nd, 1929. (337,864.)

25,795. "Aerial and/or earthing appliances for radio signalling installations." K. T. Hardman. August 24th, 1929. (337,866.)

26,007. "Machine for filling and cooking dry batteries." W. W. Triggs (H. A. Bumke Ges.). August 27th, 1929. (337,869.)

26,247. "Electric switches." J. B. Tucker. August 29th, 1929. (337,870.)

24,811. "Milliampere and/or voltage meters." Provincial Incandescent Fittings Co., Ltd., J. Webber, and J. Cooper. September 4th, 1929. (337,881.)

26,874. "Electron-discharge apparatus." Raytheon, Inc. September 17th, 1928. (319,208.)

26,889. "Electron discharge devices." British Thomson-Houston Co., Ltd. September 4th, 1928. (318,526.)

26,839. "Dynamo-electric machines." D. B. Hoseason and Associated Electrical Industries, Ltd. September 4th, 1929. (Cognate application, 33,660/29.) (337,883.)

27,280. "Sparking plugs." A. A. Postnikoff and E. P. Zerekidze. September 7th, 1929. (337,889.)

27,344. "Automatic circuit breaker for motor-car batteries or the like." G. A. H. Rohrbeck and D. U. Walldeck. September 9th, 1929. (337,890.)

27,425. "Aerial systems." M. Latour. September 20th, 1928. (Addition to 318,112.) (319,324.)

27,791. "Localising leaks in oil-filled cables." Siemens-Schuckertwerke Akt. Ges. September 22nd, 1928. (319,359.)

27,916. "Electric signalling systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. September 13th, 1929. (337,896.)

28,121. "Electrically-controlled apparatus for producing changing inscriptions." O. Sturner. September 15th, 1928. (319,192.)

28,472. "Alarm devices." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 19th, 1929. (337,904.)

28,571. "Electric motors." General Electric Co., Ltd., and N. F. T. Saunders. September 20th, 1929. (337,906.)

28,751. "Automatically varying series resistances for use with alternating current." Ferranti, Ltd., and G. L. Porter. September 23rd, 1929. (337,907.)

30,977. "Electrical transmission of moving pictures." W. E. John. October 12th, 1929. (337,931.)

31,046. "Apparatus for testing electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 13th, 1928. (337,932.)

31,337. "Electrical recording devices." Telefunken Ges. für Drahtlose Telegraphie. October 20th, 1928. (337,937.)

32,451. "Electric switches." S. Davis and Ormond Engineering Co., Ltd. October 25th, 1929. (337,952.)

32,465. "Electric switches." Julius Sax & Co., Ltd., and F. H. Collis. October 25th, 1929. (337,953.)

33,662. "Method for the manufacture of filaments for electron-discharge tubes." Etablissement Industriels de E. C. Gramnont et de A. Grammont. December 10th, 1928. (337,971.)

34,840. "Electrolytic production of aluminium." Vereinigte Aluminium-Werke Akt. Ges. November 27th, 1928. (337,995.)

35,261. "Radio-receiving systems." Marconi's Wireless Telegraph Co., Ltd. November 16th, 1928. (338,004.)

35,715. "Portable electric motor power units." E. Williams. August 8th, 1929. (Divided application on 8,419/28.) (337,834.)

35,834. "Electric switches." British Thomson-Houston Co., Ltd. November 22nd, 1928. (338,010.)

36,002. "Device for the attachment of the end connections of the rotor windings of dynamo-electric machines." Allgemeine Elektricitäts Ges. November 24th, 1928. (338,014.)

37,884. "Electronic tubes having choke coils in the leads of the electrodes." C. Lorenz Akt. Ges. January 8th, 1929. (338,028.)

38,034. "Electron-discharge tubes or thermionic valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 18th, 1929. (338,029.)

39,629. "Electric fuel pumps." Tecalemit, Ltd. December 27th, 1928. (338,046.)

1930.

1,688. "Driving systems for electromagnetic loud speakers." Ideal Werke Akt. Ges. für Drahtlose Telephonie. November 23th, 1929. (338,068.)

2,827. "Electric circuit interrupters." Associated Electrical Industries, Ltd. February 6th, 1929. (338,072.)

4,372. "Electric switches, particularly for changing tap connections of a transformer." British Thomson-Houston Co., Ltd. February 8th, 1929. (338,081.)

4,637. "Electric pocket or hand lamp." A. E. O'dell (Elektrotechnische Fabrik Schmidt & Co. Ges.). February 11th, 1930. (338,083.)

5,553. "Manufacture of aluminium by electrolysis." Compagnie de Produite Chimiques et Electrométallurgiques Alais, Froges et Camargue. March 15th, 1929. (338,084.)

6,512. "Electric motor controllers." W. E. Date. April 17th, 1929. (338,087.)

26,148. "Portable electric lamps." H. F. Joel, Sen. August 21st, 1929. (Divided application on 25,457/29.) (338,105.)

26,440. "Method of, and means for, protecting electric blasting fuses against the action of stray or undesired electric currents." Lignoza Spolka Akcyjna. June 15th, 1928. (Divided application on 17,696/29.) (337,837.)

31,138. "Reception of wireless signals." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 29th, 1928. (Divided application on 31,933/29.) (338,107.)

31,934. "Electrical insulators." Hermsdorf-Schomburg-Isolatoren Ges. December 5th, 1928. (Addition to 289,709.) (Divided application on 337,748.) (337,752.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 26th:—

Beama, British Electrical and Allied Manufacturers' Association, Inc. (lettering and design). No. 487,974. Class 6. Electrical machinery and parts. No. 487,975. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 487,976. Class 11. Instruments, apparatus, and contrivances, all being electrical goods for curative purposes. No. 487,974. Class 13 Metal goods for electrical purposes. No. 487,978. Class 16. Goods for electrical purposes made of porcelain or earthenware. No. 487,979. Class 18. Engineering, architectural, and building contrivances for electrical purposes.—British Electrical and Allied Manufacturers' Association, Inc., 36-38, Kingsway, W.C.2.

E & E. Electro-Magnetic (lettering and design) No. 514,614. Class 8. Electro-magnetic testing devices for the detection of cracks in steel.—Equipment & Engineering Co., Ltd., 2-3, Norfolk Street, Strand, W.C.2.

Enfelite. No. 515,390. Class 8. Electric cables.—Enfield Cable Works, Ltd., 296-302, High Holborn, W.C.1.

Elimistat. No. 515,973. Class 8. Apparatus for use in radio-telegraphy and telephony.—S. S. Bird, Cyldon Works, Sarnesfield Road, Enfield Town, Middlesex.

Hedralite. No. 516,963. Class 15. Reflectors, shades, and similar illuminating fittings, all made of glass.—Holophane, Ltd., Elverton Street, Westminster, S.W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHBY-DE-LA-ZOUCH. — Grammar school extensions (£12,495); Orton & Co., builders, Coalville.

AYLESBURY.—Extensions, including gymnasium at the Grammar School for the governors; Taylor & White, architects, 7, Bourbon Street.

AYRSHIRE.—School, Waterside, Dalmellington, for the county E.C.; director of education, Ayr.

BAILDON (YORKS.).—Catholic church for the Rev. Father C. McGarvey, St. Walburga's, Shipley; C. Simpson, architect, Cunliffe Terrace, Cunliffe Road, Bradford.

BARKING.—Houses (140), Alfred's Way; Suburban Developments (London), Ltd.

BARNSLEY.—Tuberculosis dispensary, with electrical work, for West Riding C.C.; county architect, Wakefield.

BEXLEY.—Maternity and child welfare centre, Welling, and maternity home extensions for the U.D.C.; surveyor.

BIRMINGHAM.—New art gallery, Cannon Hill Park, Pershore Road; Maddocks & Walford, builders, Tyburn Road, Graveley Hill, Erdington.

BRIGHTON.—Clearance and rehousing scheme, Sun Street (£184,000); borough engineer. Offices and showrooms, 24, Old Steine; H. D. Butler.

BROWNHILLS.—Houses (250) for the U.D.C.; surveyor.

CARLISLE.—Technical and central schools for the city E.C.; director of education.

CHESHIRE.—Primary school (320 places), Frodsham, for the county E.C.; director of education, Chester.

CHICHESTER.—Post office, West Street, for H.M. Office of Works, King Charles Street, London, S.W.

COSELEY.—Handicraft, domestic and science centres, for the E.C.; Scott & Clark, architects, Regent Chambers, Wednesbury.

DARWEN.—Public baths (£36,000); borough surveyor.

DERBYSHIRE.—Extensions, Cavendish Girls' High School, Buxton, for the county E.C.; G. H. Widdows, county architect, St. Mary's Gate, Derby.

DEWSBURY.—Extensions, Town Hall, for the T.C.; borough surveyor.

DUNFERMLINE.—Extensions, including three-storey warehouse, Bruce Street, for William Stevenson & Sons.

GARDENSTOWN (BANFFSHIRE).—Erection of memorial institute; William Duncan, architect, Hallhill House, Hallhill, Turriff, Aberdeenshire.

GLASGOW.—Houses, Knightswood (384), and Whitelaw Street (150); housing director and trade contractors. Catholic school, Tolcross, and new trades school for the E.C.

GRIMSBY.—Maternity home, Nunsthorpe (£14,486); Steel and Goddard. Elementary school, Carr Lane, for the E.C.

HANLEY.—Workshops, &c. (£27,000) for Stoke and North Staffs Committee for the Care of the Blind; secretary.

HIGH WYCOMBE.—Library, art gallery, and museum, for the T.C.; R. G. Brocklehurst, architect.

HUDDERSFIELD.—Additions, Crossland Moor Institution, with electrical work, for the T.C.; borough architect, 26, Ramsden Street.

HULL.—Public library, Newland, for the T.C.; borough surveyor.

HUNTINGDON.—Vegetable canning factory; Chivers & Sons, Ltd., Histon.

KIRKCUDBRIGHT.—Academy gymnasium (£10,000); W. A. Mackinnell, architect.

LANCASHIRE.—Senior schools, Poulton, Westhoughton (£37,000) and Little Lever (£13,000); and infants' school, Shakerley Common, Tyldesley, for the County E.C.; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LEYLAND.—Sewage disposal works, Ulnes Walton (£33,750); surveyor to U.D.C.

LIVERPOOL.—Cinema, Oakfield Road, for General Theatre Corporation, Ltd.; Geo. Platt & Sons, Ltd., builders, Westmorland Street.

LONDON (HORNSEY, N.).—Extensions, high school for girls (£15,040); J. Laing & Son, Ltd., Mill Hill. Science block, Stationers' School (£25,943); Henry Knight & Son, Tottenham.

(CAMBERWELL, S.E.).—Remodelling, Reddins Street School (£10,742); Thomas D. Leng, Deptford.

(LEWISHAM, S.E.).—Cinema, Sydenham Road; A. C Matthews.

(WOOLWICH, S.E.).—Extensions, Woolwich Polytechnic, Thomas Street (£15,500); governors.

(BRIXTON, S.W.).—School (1,300 places); L.C.C., architect.

(CLAPHAM PARK, S.W.).—School (500 places); L.C.C., architect.

(PUTNEY, S.W.).—New premises for Putney Treatment Centre; governors.

(STREATHAM HILL, S.W.).—School (400 places); L.C.C., architect.

LOWESTOFT.—Houses (108) for the T.C.; S. W. Mobbs, borough surveyor.

MANCHESTER.—Enlargement, Briscoe Lane Council School, Newton Heath (900 places); acting director of education, Education Offices, Deansgate.

MIDDLESBROUGH.—Fire station, Park Road, S. (£30,000); borough surveyor.

MIDDLESEX.—Schools, Ashford, Pinner, South Ruislip, and Hampton, for the county E.C.; director of education, 40, Eccleston Square, S.W. School, Preston, Wembley, for the county E.C. (£15,650); Y. J. Lovell & Sons, Gerrards Cross.

MONMOUTHSHIRE.—Schools, Bedwas and Trethomas, for the county E.C.; director of education, Newport.

NEWCASTLE-ON-TYNE.—Elementary school (500 places), Clifford Road; director of education, City Education Offices. Premises, Newgate Street, for the Co-operative Wholesale Department; Building Department, C.W.S., Ltd. West Brandsford Street. Factory, Gateshead, for Messrs. Jackson, Clayton Street; Marcus Glass, architect, 20, Saville Row. Conversion of Palace of Arts at North-East Coast Exhibition to museum, with electrical work; Corporation Moor and Parks Committee. Baths at Byker, Fenham, Jesmond, and Scotswood, for the City Council.

NORTHAMPTON.—Technical college (£75,350) for the borough E.C.; A. Glenn & Sons, Ltd., builders.

ORMSKIRK.—Training college; director of education, County Offices, Preston.

RICHMOND (YORKS.).—Modernising of Wesleyan Methodist College (£15,000); Rev. Dr. Ryder Smith, governor.

SALFORD.—Senior school (£14,000) for the Catholic managers; Rev. John J. Welch.

SALISBURY.—Houses (50) for the T.C.; city surveyor.

SHAP (CUMBERLAND).—Church for the Wesleyan trustees; A. Knewstubb, architect, St. Andrew's Chambers, Penrith.

SHIRLEY.—Shops (15), Wickham Road; Chart, Son and Reading.

SIDMOUTH.—Houses (90), Manstone Lane housing estate; L. M. Blanchard, architect, Council Offices.

SOUTHPORT.—Extensions, New Hall Hospital (£37,000), for the T.C.; borough surveyor.

STOKE-ON-TRENT.—Houses (50), Swan Lane (£20,545); Corporation Works Department.

SUNDERLAND.—Two senior schools (320 places each), Ford estate, for the E.C. Four-storey factory, Nile Street, for Morris Winberg, wholesale cabinet maker.

WALLINGTON.—Church; Newberry & Fowler, architects.

WEST LOTHIAN.—Houses (400) for C.C.; county clerk.

WILTS.—Schools, Chiseldon and Wootton Bassett, for the county E.C.; director of education, Trowbridge.

WOKING.—Houses (94) for the U.D.C.; surveyor.

WRENTHAM (SUFFOLK).—Rebuilding Sherlock Works for S. G. Sawyer.

YEOVIL.—Schools (£40,000) for the borough E.C.; director of education.

YORK.—Houses (650) and flats (64), Burton Stone estate; city architect.